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Plain Milling Machine.

The accompanying engraving shows a style of milling machine recently brought out by the Brown & Sharpe Manufacturing Company, of Providence, R. I. The machine resembles their No. 1 universal machine, with which our readers are of course familiar, but being intended for a different class of work, and more particularly for manufacturing operations, the platen does not swivel, but moves in a line at right angles to the spindle, and there is no spiral or indexing head, nor any foot-stock.

The saddle and platen are made heavier than in the No. 1 machine, and provision is made, as shown, for connecting the outer end of the overhanging arm rigidly to the knee. It has been shown by experience that it is very advantageous to be able to do this after the machine is properly adjusted for a cut, whether a number of duplicate cuts are to be taken or a single cut nearly or quite as heavy as the machine is capable of.

The overhanging arm is arranged to support the outer end of the arbor, either on a center or by a parallel bearing, as may be preferred. The spindle bearings are of bronze, and, like the spindle itself, are ground on a universal grinding machine. Wear is taken up by the longitudinal movement of the spindle, and the end thrust by a collar bearing upon the main box. The cone is four-stepped, for a 3″ belt.

The vertical movement of the knee is 19″ and the movement of the saddle upon the knee in line with the spindle, 6¾″.

The platen is 32″ long, 7″ wide, has an automatic feed of 20″, which is automatically thrown out at any desired point when feeding in either direction. There are three T slots for securing work.

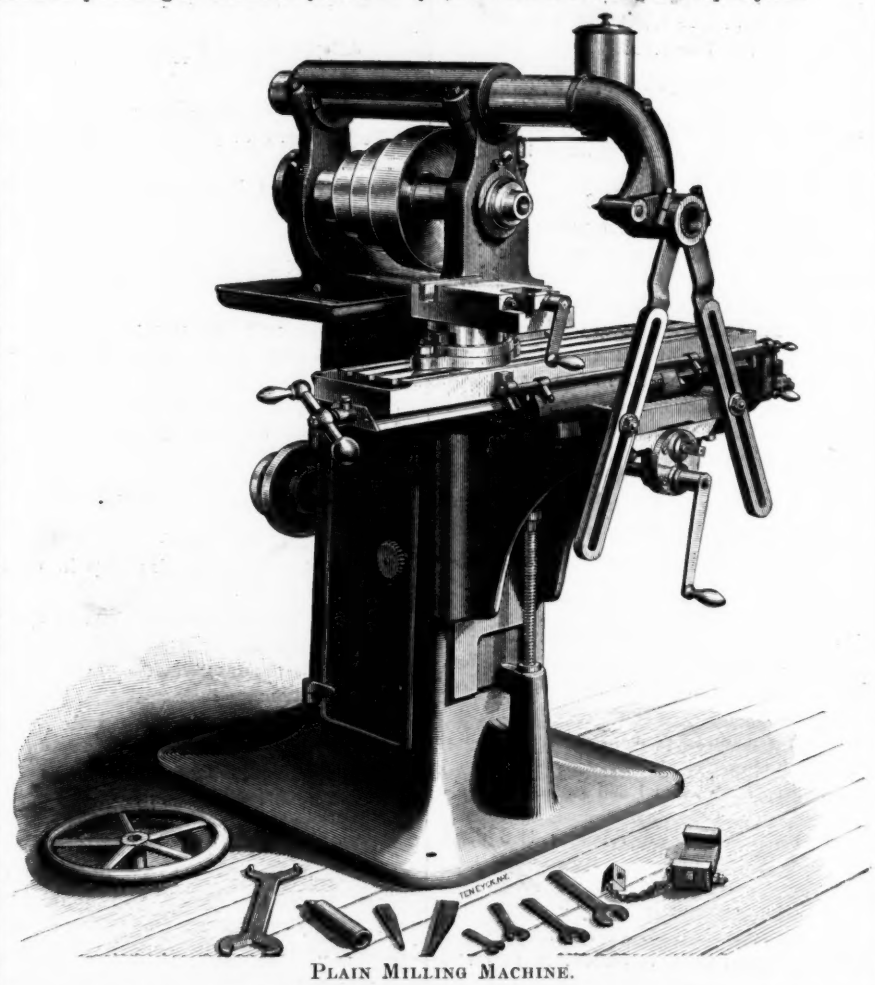
There are six changes of feed, the finest being .008″ and the coarsest .1″ per revolution of spindle. The vise swivels and has a graduated base. The jaws are 6½″ wide, 1 7/16″ deep, and can be opened to 2⅝″. The machine weighs, boxed for shipment, about 1,850 pounds.

I-Beam Punching and Coping Machine.

The second illustration on this page represents one of the latest machines brought out by the Long & Allstatter Company, of Hamilton, Ohio. It is designed especially for various operations upon I-beams, channel bars, angle bars, etc., for which purpose it seems admirably well fitted.

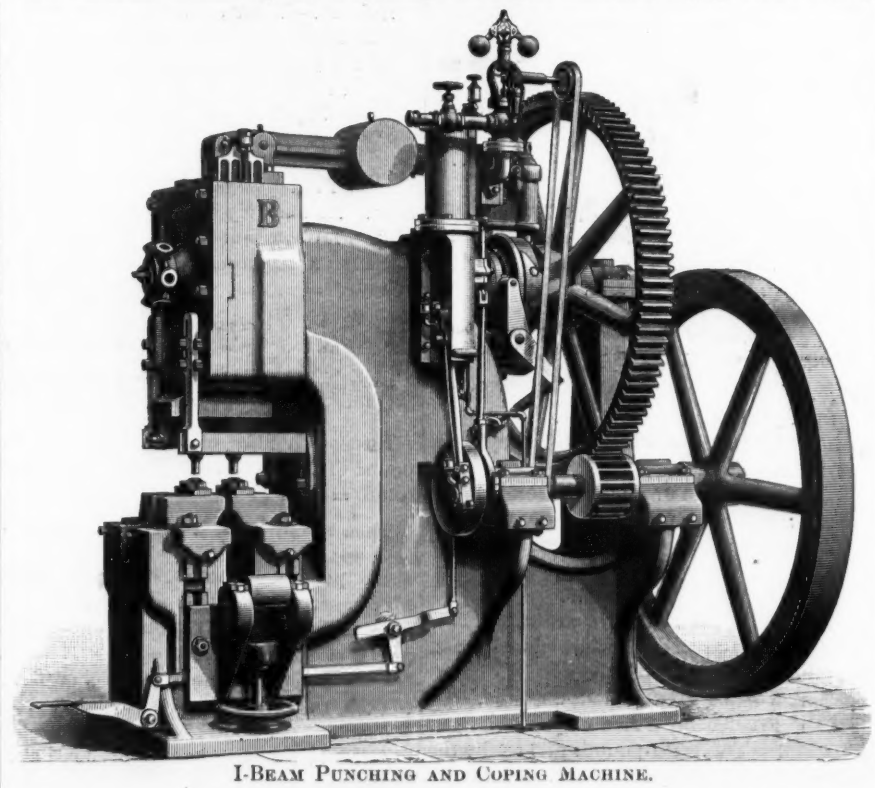
The machine is shown in the illustration as fitted with two punches for simultaneously punching two holes in the flanges of I-beams, but a mere change of tools fits the machine for various operations. The die block is double, and the I-beam is pushed between them with its flanges resting on the dies, an adjustable roller under the beam rendering the shifting easy.

Each descent of the ram punches a hole in each flange at the top of the beam. The two punches and their dies are adjustable to and from each other, to regulate the distance between holes, and they are independently adjustable in the other horizontal direction, so that the two holes, instead of being opposite each other, may bear any relation desired. These punches and dies are readily removed, to be replaced by tools for punching a number of holes at once in the web of beams, etc., or for any kind of punching in beams or plates, or by shear blades, for the usual operations upon plates, bars, etc.



PLAIN MILLING MACHINE.

The machine is also capable of forming complete, and in the most admirable manner, the coped joints in beam work, channel work, etc. When this is to be done, the punches and dies are replaced by a single set of coping tools, which perform the entire work of forming the coped joint.



I-BEAM PUNCHING AND COPING MACHINE.

The machine is made in a number of sizes suitable for coping the different sized beams, the largest machines coping beams twenty-four inches deep and below, while the smallest machines will cope six-inch beams and below. Throat depth varies to suit requirements, from twelve to forty-eight inches. These machines all have automatic stops, which bring the tools to rest at any desired point of the stroke. The illustration shows the machine as self-contained, having steam engine attached, thus only requiring steam connection to put it in condition for running; but the machine is also built to be operated by belt on tight and loose pulley.

Compound Engines.

BY JAMES TRIBE.

SIXTH PAPER.

TRIPLE-EXPANSION CONDENSING ENGINES.

Probably there is no other type of engine so economical as the triple-expansion condensing, providing a suitable initial steam pressure of say 160 pounds above the atmosphere can be guaranteed. Nevertheless, the quadruple expansion is considered by some as possessing certain theoretical advantages, which may be true; but the theory is not very strongly sustained when brought into actual practice.

METHODS OF CYLINDER ARRANGEMENT.

In the triple-expansion engine, like all other styles, there are various methods of arranging the cylinders. Such is the vertical cross compound, with one cylinder to each crank, and cranks set at 120° to each other, cylinders above and crankshaft below.

This doubtless is an excellent arrangement, both for distribution of the power upon the main shaft, and also considering the small amount of floor space necessary per horse-power. Then there is the horizontal triple-tandem with its three pistons on one rod, and which may be arranged in pairs, making six cylinders to one main shaft and fly wheel.

There is also an arrangement which is often adopted forming a horizontal cross compound, having high-pressure and intermediate cylinders on one piston rod and crank, and the low-pressure upon the other rod and crank, and crank set at 90°.

To the latter arrangements objections are made, upon the ground that, as the cylinders of a well-designed triple-compound engine should develop about equal power in each of its cylinders, in the above arrangement two-thirds of the power would be transmitted through one crank, and only one-third through the other.

Within the last few years, however, there have been several triple-expansion engines built in which this objection has been satisfactorily met, and the power thereby equally divided between the two cranks. This is accomplished in the following way: Four cylinders are employed instead of three, but acting only as a triple-expansion. The high-pressure and intermediate cylinders remain the same, but the low-pressure area is divided and two low-pressure cylinders employed instead of one, and taking steam from one common receiver. Thus one half of the low-pressure power can be carried upon the same piston rod with the high-pressure, and the other half with the intermediate—so forming a pair of tandem engines, in which the strain upon the crankshaft is approximately uniform.

This arrangement also avoids the excessive diameter of one large low-pressure cylinder,

and the consequent inconvenient height of the main shaft, necessary to keep it and valve gear above the engine room floor.

The following calculations will not be practically affected by the different methods of cylinder arrangement, unless it is that the greater or lesser exposure of cylinder and receiver surfaces may effect a different percentage of loss, but which we will not undertake to consider at this time.

It is my object in this paper to work out one example for the purpose of showing how to determine throughout the sizes of cylinder, receivers, condensing apparatus, etc., of a triple-expansion condensing compound engine, as best calculated to meet the conditions specified in the example. Frequent reference will be made to earlier papers, and in a few cases a repetition of some of the given rules may be found convenient.

Example 11.—Compute all the principal proportions of a triple-expansion condensing engine consisting of three cylinders, two receivers and condensing apparatus; to carry an initial steam pressure of 160 pounds above the atmosphere; to run 60 revolutions per minute; stroke, 5 feet; and to indicate 1,500 horse-power.

Taking the example in its order, we will consider first the high-pressure cylinder, then the first receiver, next the intermediate cylinder and the second receiver, then low-pressure cylinder, and last, the condenser, air-pump and injection water; following step by step in their order, and in the same manner as we did in some of the earlier examples.

EXPANSIONS.

1st. Find total number of expansions.

Rule 1.—Steam pressure absolute divided by the terminal pressure in low-pressure cylinder.

$160 + 15 = 175$ pounds absolute.

Table 2. Terminal pressure equals six pounds.

$\therefore 175 + 6 = 29$, minus 7 per cent. loss = 27 expansions.

2d. Find number of expansions in each cylinder.

Rule 2.—Extract the cube root of total expansions. Total expansions = 27.

$\therefore \sqrt[3]{27} = 3$ expansions in each cylinder.

HIGH-PRESSURE.

3d. Find forward pressure per square inch.

Rule 4.—Initial pressure multiplied by hyp. log. of expansion + 1 and divided by number of expansions.

Hyp. log. 3 = 1.098
Hyp. log. + 1 = 2.098

$$\frac{175 \times 2.098}{3} = 122.3 \text{ pounds.}$$

4th. Find back pressure per square inch.

NOTE.—Back pressure should equal terminal pressure.

Rule 5.—Initial pressure divided by number of expansions.

$175 \div 3 = 58$ pounds terminal or back pressure.

5th. Find mean effective pressure per square inch.

Rule 6.—Forward pressure minus back pressure.

$122.3 - 58 = 64.3$ pounds, M. E. pressure.

6th. Find effective area of piston.

Rule 7.—Total foot-pounds divided by the product of piston speed in feet per minute multiplied by mean effective pressure.

NOTE.—The work in each cylinder should be equal, viz., 500 horse power in each.

$\therefore 500 \times 33{,}000 = 16{,}500{,}000$ foot-pounds, which is the product of piston speed $\times$ by mean effective pressure $\times$ by effective area.

Piston speed $= 5 \times 2 \times 60 = 600$ feet per minute and $600 \times 64.3 \times$ effective area.

$$\frac{16{,}500{,}000}{600 \times 64.3} = 427 \text{ square inches, high-pressure piston.}$$

7th. Find the diameter of cylinder.

Rule 8.—Extract the square root of effective area of piston plus half area of rod divided by .7854.

NOTE.—Assume half area of rod as 15 square inches.

$427 + 15 = 442$ square inches area.

$$\sqrt{\frac{442}{.7854}} = \sqrt{560} = 23.6 \text{ diameter.}$$

FIRST RECEIVER.

8th. Find volume of receiver and connecting pipes between high-pressure and intermediate cylinders.

Rule 13.—High-pressure cylinder volume multiplied by 4.

$427 \times 60 \times 4 = 102{,}480$ cubic inches.

INTERMEDIATE CYLINDER.

9th. Find initial pressure per square inch in pounds absolute.

Rule 9.—Terminal pressure in high-pressure cylinder less 3 per cent.

58 less 3 per cent. $= 58 - 2 = 56$ pounds.

10th. Find mean forward pressure.

Rule 4.—Initial pressure multiplied by hyp. log. of expansion plus 1, and divide by the number of expansions.

Hyp. log. of 3 = 1.098.
Hyp. log. + 1 = 2.098.

$$\frac{56 \times 2.098}{3} = 39 \text{ pounds per square inch.}$$

11th. Find terminal or back pressure.

Rule 5.—Initial pressure divided by number of expansions.

$56 \div 3 = 18.6$.

12th. Find mean effective pressure.

Rule 6.—Forward pressure minus back pressure.

$39 - 18.6 = 20.4$ pounds absolute.

13th. Find effective area of piston.

Rule 7.—Total foot-pounds divided by the product of piston speed in feet per minute multiplied by mean effective pressure.

NOTE.—This cylinder also should develop 500 horse-power.

Or $500 \times 33{,}000 = 16{,}500{,}000$ foot-pounds.

$\therefore$ Piston speed $\times$ by mean effective pressure $\times$ by effective area = 16,500,000.

Viz. $600 \times 20.4 \times$ effective area,

$$\text{or } \frac{16{,}500{,}000}{600 \times 20.4} = 1{,}348 \text{ square inches.}$$

14th. Find diameter of cylinder.

Rule 8.—Extract the square root of effective area of piston plus half area of rod divided by .7854.

NOTE.—Assume half area of rod as 18 square inches.

Then $1{,}348 + 18 = 1{,}366$ square inches,

and $\sqrt{\frac{1{,}366}{.7854}} = \sqrt{1{,}742} = 41.8$ diameter.

SECOND RECEIVER.

15th. Find volume of receiver and connecting pipes between intermediate and low-pressure cylinders.

Rule 14.—Intermediate cylinder volume multiplied by 3.

$1{,}348 \times 60 \times 3 = 242{,}640$ cubic inches.

LOW-PRESSURE.

16th. Find initial pressure in pounds absolute.

Rule 9.—Terminal pressure in intermediate cylinder less 4 per cent.

18.6 less 4 per cent. $= 18.6 - .7 = 17.9$ pounds.

17th. Find mean forward pressure.

Rule 4.—Initial pressure multiplied by hyp. log. of number of expansions.

$\therefore$ Hyp. log. of 3 = 1.098.
Hyp. log. + 1 = 2.098.

$$\frac{17.9 \times 2.098}{3} = 12.5 \text{ pounds per square inch.}$$

18th. Find terminal pressure.

Rule 5.—Initial pressure divided by number of expansions.

$17.9 \div 3 = 5.97$ pounds absolute.

19th. Find back pressure (approximately).

Rule 15.—Terminal pressure multiplied by .66.

$5.97 \times .66 = 3.9$.

20th. Find mean effective pressure.

Rule 6.—Forward pressure minus back pressure.

$12.5 - 3.9 = 8.6$ pounds absolute.

21st Find effective area of piston.

Rule 7.—Total foot-pounds divided by the product of piston speed in feet per minute multiplied by mean effective pressure.

NOTE.—This cylinder also is to develop 500 horse-power.

$500 \times 33{,}000 = 16{,}500{,}000$ foot pounds.

Piston speed by mean effective pressure by effective area, viz.:

600×8.6 by effective area.

$$\frac{16{,}500{,}000}{600 \times 8.6} = 3{,}197 \text{ square inches.}$$

22d. Find diameter of cylinder.

Rule 8.—Extract square root of effective area of piston plus half area of rod divided by .7854.

NOTE.—Assume half area of rod as 20 square inches; $3{,}197 + 20 = 3{,}217$ square inches.

$$\sqrt{\frac{3217}{.7854}} = \sqrt{4{,}096} = 64'' \text{ diameter.}$$

Collecting the results of the above calculations together we have:

HIGH-PRESSURE.

Effective area of piston square inch = 427.

Speed of piston in feet per minute = 600.

Mean effective pressure per square inch = 64.3.

$$\frac{427 \times 600 \times 64.3}{33{,}000} = 500 \text{ H. P.}$$

INTERMEDIATE.

Effective area of piston in square inches = 1,348.

Speed of piston in feet per minute = 600.

Mean effective pressure per square inch = 20.4.

$$\frac{1{,}348 \times 600 \times 20.4}{33{,}000} = 500 \text{ H. P.}$$

LOW-PRESSURE.

Effective area of piston in square inches = 3,197.

Speed of piston in feet per minute = 600.

Mean effective pressure per square inch = 8.6.

$$\frac{3{,}197 \times 600 \times 8.6}{33{,}000} = 500 \text{ H. P.}$$

AIR PUMP.

23d. Find volume of air-pump in cubic feet.

Rule 10.—Volume of low-pressure cylinder in cubic feet multiplied by 3.5, and divided by number of cubic feet in one pound of exhaust steam.

$$\frac{\text{Vol. of cyl. in cubic ft.} \times 3.5}{\text{cubic ft. in 1 lb. of ex. steam}} = \text{volume of air-pump in cubic feet.}$$

$$\frac{22.2 \times 10 \times 3.5}{61.2} = 12.7 \text{ cubic feet.}$$

24th. Find diameter of pump.

Assuming the stroke to be 18 inches, or 1.5 feet, then $12.7 \div 1.5 = 8.46$ square feet, or 1,218 square inches; and 1,218 square inches in area = $39\frac{1}{2}$ diameter; $39\frac{1}{2}$ diameter $\times$ 18″ stroke.

CONDENSER.

25th. Find diameter of condenser, assuming its length to be 84″.

Rule 11.—Volume of air-pump $\times$ by 4 and divide by length of condenser in inches.

$$\frac{21.924 \times 4}{84} = 1{,}044 \text{ square in.} = 36\tfrac{1}{2} \text{ dia.}$$

$36\frac{1}{2}$ diameter $\times$ 84″ long.

INJECTION WATER.

26th. Find gallons of injection water per hour. Assume injection 50° and overflow 110°. Low-pressure cylinder being 64″ diameter $\times$ 60 stroke, we have volume of cylinder $= 3{,}217 \times 60 = 193{,}020$ cubic inches.

Volume of steam per revolution $= 193{,}020 \times 2 = 386{,}040$ cubic inches;

$$\text{or } \frac{386{,}040}{1{,}728} = 223 \text{ cubic feet.}$$

NOTE.—Number of cubic feet in one pound of steam at 5.97 pounds pressure absolute = 61.

Then we have $\frac{223}{61} = 3.6$ pounds of steam per revolution of engine; and from fifth paper we find that at the above temperatures we require 17 pounds of water per pound of steam; therefore $3.6 \times 17 = 61.2$ pounds per revolution of engine, or $61.2 \times 60 \times 60 = 220{,}320$ pounds per hour, or 26,544 gallons per hour.

Allow 12 per cent. loss and we need about 30,000 gallons per hour.

INJECTION VALVE.

27th. Find the diameter of injection valve.

Rule 12.—Volume of air-pump in cubic inches divided by 520.

Volume of $39\frac{1}{2}$ diameter $\times$ 18″ stroke = 21,924 cubic inches.

$$\therefore \frac{21{,}924}{520} = 42 \text{ square in. area,}$$

or about $7\frac{1}{2}$″ diameter.

A telegraph operator on one of the single-track roads leading out of Pittsburgh has had an experience that will last him a lifetime, says the Pittsburgh *Dispatch*.

The young man became careless, as dispatchers sometimes will, and he gave orders for a freight and passenger train, moving in opposite directions, to go to a certain station.

When the trains had started, the operator suddenly remembered that they couldn't reach the place without a collision. It was too late to countermand the order, and in his agony cold drops of perspiration ran down over his face.

In describing his feelings afterwards, he said he lived years in the few short minutes which would decide the fate of the trains.

He was startled and relieved by seeing the engineer of the freight walk into the tower. The engineer had received his orders, but when he reached a switch he had a premonition there was something wrong, and he turned in on the side track. His train was scarcely out of the way when the express thundered by.

The next day the operator went to the superintendent of the road and told him what had happened, at the same time handing in his resignation.

The manager looked at him for a moment, and then said: "Go back to your work, my boy. This experience has been a lesson for you. I don't think it will occur in the future."

Ships of the Ancients.

Large ships were not unknown to the ancients, and some of the most roomy attained dimensions equal to ships of modern times. Nevertheless, they were unmanageable monstrosities, almost at the mercy of wind and wave, and utterly unfit to cope with the fury of a hurricane. Doubtless we are indebted to travelers' tales for the detailed descriptions that survive the lapse of ages. Constantius conveyed from Heliopolis to Rome an obelisk weighing 1,500 tons, and, in addition to this long-coveted monolith, the ship carried about 1,200 tons of pulse stowed about the smaller end of the obelisk, in order to bring the ship on an even keel.

In 268 B. C., Archimedes devised a marvelous ship for Hierò of Syracuse. Her three lofty masts had been brought from Britain, whereas our ship's masts are of iron, and obtained from New Zealand, or from Vancouver Island. Luxuriously fitted sleeping apartments abounded, and one of her banqueting halls was paved with agate and costly Sicilian stone. Other floors were cunningly inlaid with scenes from the Iliad. Stables for many horses, ponds stocked with live fish, gardens watered by artificial rivulets, and hot baths were provided for use or amusements. Ptolemy Philopater possessed a nuptial yacht, the Thalamegron, 312 feet long and 45 feet deep. A graceful gallery, supported by curiously-carved columns, ran round the vessel, and within were temples of Venus and of Bacchus. Her masts were 100 feet high, her sails and cordage of royal purple hue.—*Chambers' Journal.*

A Year's Work in the Post-office.

In the yearly reports of the departments of the New York Post-office, it appears that, during 1891, 314,724,612 pieces of ordinary mail matter were delivered through lock boxes and by carriers. In the registered letter department 1,520,317 pieces were delivered, and 1,944,026 were registered. In the distribution department 771,838,051 pieces were handled. The total number of pieces of mail matter of all kinds handled during the year was 1,150,027,006, a daily average of 3,495,523, and an increase of 125,828,285 over last year. The money order

business showed an aggregate of $106,869,047, an increase over 1890 of $5,534,868.75. The total receipts of the office were $6,505,952.08, and the total expenditure was $2,525,540.59, giving a net revenue of $3,980,411.49.—*Evening Post.*

A New Milling Machine Dog.

Often taper work is done on a milling machine between centers, and an ordinary dog with a bent taper tail is used for carrying the article to be milled. Referring to Fig. 1 it will be noticed that the action which takes place by revolving the work is a continuous gaining and losing one. This is due to the fact that the bent tail continuously changes its position at the point of driving. It readily can be seen that it twists right and left, and at the same time slides forward and back as the dog changes from vertical to horizontal position in turning over. Now if the set screw which holds the tail to the dog carrier is not released for every partial revolution, the tendency is to either spring or bend light work, or it will throw an enormous strain between centers on heavy work, so that it is almost impossible to revolve it, and causing uneven divisions. This matter is more fully treated in our issues of April 18, 1885, and March 31, 1888. Figs. 2 and 3 represent what is called a milling machine dog in which the above defects are overcome. The tail of the same is turned cylindrical, and is offset, so that the center line through the cylindrical part is in line with the end of the work when the dog is set flush. In addition to the dog there is an adjustable clamp attached to the regular dog driver, which firmly holds any size dog and at the same time admits the tail to swivel either way or slide forward and backward. With a dog and clamp of this design, taper or straight work may be revolved between centers and held firmly in any position without any strain whatever. The same arrangement can be used on lathe work, and it is especially advantageous for thread cutting, for two reasons: First, where taper threads are cut between centers with the old style dog, the action of losing and gaining on the thread takes place the same as in the milling machine work, and produces what is called a drunken thread; by using the improved dog this trouble is entirely avoided. Second, there is no back lash in reversing the lathe, and a dog of this pattern is always on time.

All sizes from ¼″ to 2½″ are made and furnished with a well-finished tool steel screw (threaded in the lathe) with a tempered point. The Cincinnati Milling Machine Co., Cincinnati, O., are the manufacturers of the clamps and dogs.

Multiple Spindle Boring Machine.

We illustrate herewith a machine which is designed for accurate and rapid boring, for furniture, table leaf work and agricultural implements, etc.

The frame is composed entirely of iron, and on top of this, back of the work table, the spindle frames are mounted in such a way that the two outer ones can be adjusted to or from the center one, to make the distance between holes anything desired from 4″ up. The spindles are adjusted independently, and each is driven by an independent belt. The table is raised for adjustment by means of the screws and bevel gears seen in front of the machine, and the table carrying the work is fed forward to the bits by the treadle, the movement of which is adjustable to suit the work to be done.

The work is clamped at three places simultaneously, all the screws being moved together by means of the crank at the center, one-quarter turn of this moving the screws downwards ¼″. This insures that the work shall be held straight and firmly secured, an end stop locating it endwise. The table automatically returns to its position after the holes are bored. The machine is made with one or two spindles when desired, or as shown in the illustration, by The Egan Co., 239 to 259 West Front street, Cincinnati, Ohio.

Indexing Drawings.

By J. V. SCHAEFER.

The value of an index to a case full of drawings, which will enable any one of them to be found readily, and will also serve as a catalogue of such drawings in any particular line as may be at hand, cannot be over-estimated. As this indexing is a problem which sooner or later comes to almost every draftsman and superintendent, the writer has thought that the readers of the AMERICAN MACHINIST would be interested in reading how the Link Belt Machinery Co. has solved it.

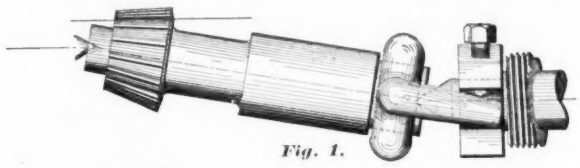


Fig. 1.

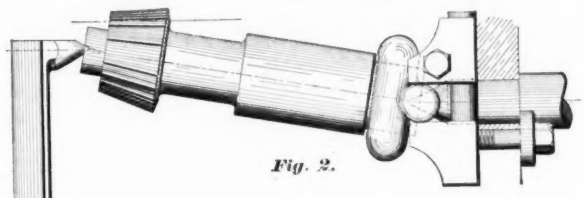


Fig. 2.

Fig. 3.

A NEW MILLING MACHINE DOG.

The problem, as it was presented to the writer about a year ago, and as it no doubt presents itself now to many readers of this article, was about as follows: There were about 4,000 drawings worth keeping. Of these, about 1,000 were tracings of a standard size, another 1,000 were drawings—some in pencil, some in ink—also of a standard size. The remainder were miscellaneous drawings, blue prints, sketches and tracings in great variety.

The tracings were kept in pockets made like the covers of a book, with three edges closed, two of them being accordeon edges. These pockets were numbered and marked as I. Conveyors, IX. Rope Transmissions, etc. The drawings were similarly kept. The miscellaneous drawings, sketches, etc., were kept any and every way. There was a book purporting to be a register of drawings, but, as it was incomplete, it had fallen into a state of "innocuous desuetude," and so the only way to find a drawing was to skirmish around and find it the best way you could, and if you didn't find it, declare it was lost. The embarrassment felt by the head draftsman when the superintendent or foreman came in, in a hurry, to "just have a look at drawing made for —— —— about a year ago," can only be appreciated by those who have been similarly placed.

The first thing done was to fix upon standard sizes of drawings. These were fixed at 24″x36″ and 18″x24″ for drawings, and 8″x10½″ for sketches. The next thing was to relegate the accordeon pocket abomination to the waste basket, and provide cases of drawers for all the drawings. All drawings were then carefully examined. Many had no titles. Such of these as could be in any way identified were given titles, the others thrown away. They were then numbered consecutively, and recorded in a book or drawing register. This book has upon the left-hand page room for the drawing number and title only. The right-hand page has columns headed as follows:

Shop Order No., Date, Drawn by, Time, Traced by, Time, Record Copy.

D	T	B P

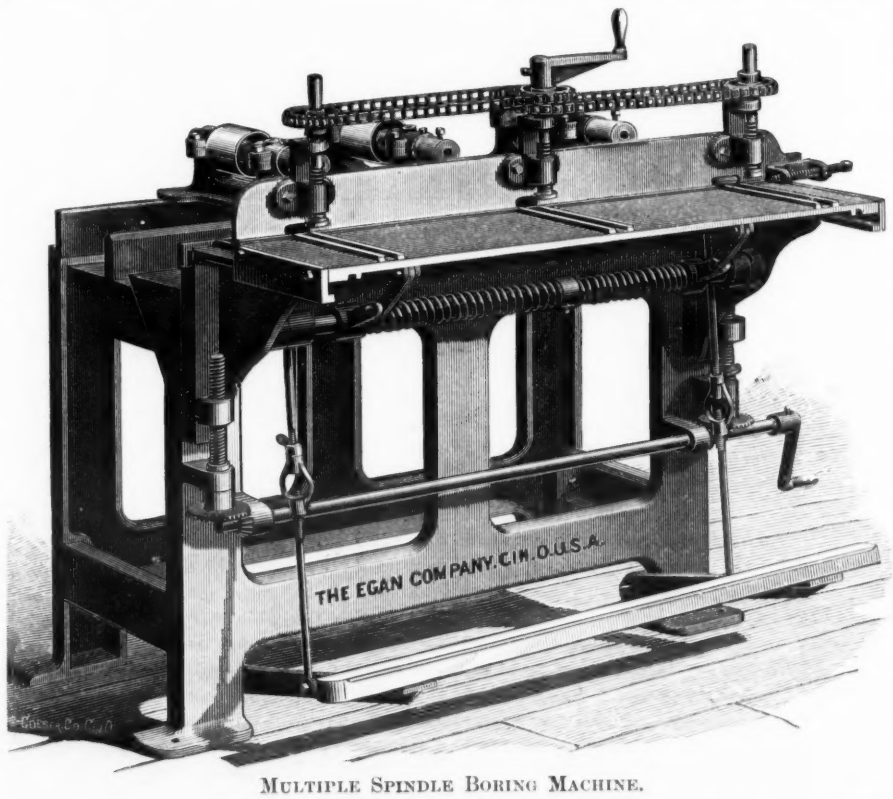
REMARKS.—These will explain themselves: The drawings, blue prints, tracings and sketches were then placed in drawers by themselves, being folded when necessary to make them fit the drawers. The drawers were numbered and each has a tag something like this:

TRACINGS
67 to 300.

The most difficult part now remained, however, in making a finding list which should be complete, easy to use, and sufficiently flexible to permit changes and additions to be readily made.

The only index which fulfills all these conditions, so far as we know, is the card shown in next column.

This card shows one of a set of six cards written for a set of three drawings, as there shown. Every drawing is represented by a card under the firm name, while a whole set of drawings for some one order is only represented by one card under the various headings, or index words, by which it is liable to be thought of. The index words in this case are Standard, Oxide, Elevator and Conveyor.



MULTIPLE SPINDLE BORING MACHINE.

These index words are always underscored in the drawing register and on every card, so that finding one card of the series will indicate how many other cards there are. So in the case here shown there are three cards under the word Standard, having the drawings 4117, 4110, 4100 at the top respectively, with their location, date and name of draftsman, and references to the other two. Then there will be one card under each of the index words Oxide, Elevator and Conveyor, with references.

Class..24.....	Are in Drawers,—	Drawing.	Tracing.	Blue Print.
Drawing No.	DESCRIPTION: Standard Oil Co.		62	
4117	*Oxide, Elevator* and *Conveyor.*			
Cross References.	General Drawing.			
4100	.....			
4110	Special Take Up Box with Stuffing Box.			
	Box for Conveyor, Trough, Shafting and Wearing Block.			
Oct. 26, 1891.	Made by	Anderson.		

These cards are filed away alphabetically in drawers made for the purpose, and are held in place by a rod passing through the hole at the bottom.

Any one who can read English can by means of these cards find in a few minutes any drawing there is in the drafting room. He can also tell what variety of material we have built elevators or conveyors for; or, given the material, he can tell if we have any drawings for appliances for handling the same. If a drawing is destroyed, all the cards pertaining to it can be found readily and destroyed, and as new cards are written they take their place in between the others in their regular alphabetical order.

This index may not be the best kind for the purpose. It certainly is the best the writer has seen, and is as faultless as he has been able to make it. This article is given to the readers of the AMERICAN MACHINIST with the hope, first, that others may be benefitted by it, and secondly, with the hope that, if imperfections or undue complications still exist in it, they may be eliminated by the aid of the fraternal criticism we are wont to see in these columns.

Natural Gas.

Mr. Albert Carpenter, of Muncie, Ind., writes us to the effect that we do an injustice to the natural gas products of that part of the country. He says that where the wells are not put down too thickly the pressure holds good. Mr. Carpenter is in charge of, we believe, the Muncie Foundry and Machine Works, and he says: "With an automatic regulator for the gas, and a float in the boiler to regulate the water, we almost do away with the services of an engineer."

We have no faith in the idea of doing away with the services of an engineer, but do not doubt but the natural gas and the appliances named render his duties less arduous. We have really taken no stand in the matter of natural gas, except to intimate that the supply in any particular locality was, in the nature of things, likely to fail, just about as everything else is liable to failure.

Eighty-five men recently erected a locomotive in ten working hours at the Stratford Works of the Great Eastern Railroad in England.

A man was recently arrested for stealing seventy-six fathoms of rope in Hoboken, N. J. Nothing small about the operation.

Theory of the Polar Planimeter.

BY EMIL THEIRS.

Although the polar planimeter is an instrument in daily use, yet the theory of its action is probably fully understood by few of the many to whom it is indispensable. A clear and elementary exposition of its theory will therefore, it is supposed, be of interest to the readers of the AMERICAN MACHINIST.

It is presumed that the construction of the instrument is sufficiently well known to make a description unnecessary.

In order to arrive at the relation existing between the arc through which the measuring wheel of the instrument revolves, and the part described upon the plane of the paper by the point of tangency, let it be assumed that a straight-edge $M N$, Fig. 1, is provided with any number of small wheels, all in one plane, and all touching the paper. For any movement of the straight-edge all wheels will revolve through the same arc. In proof of this, in Fig. 2, let $M N$ be moved into the position $M' N'$. The movement may be considered as made up of a rotation of $M N$ about S, the point of intersection of the directions $M N$ and $M' N'$, and of a motion of translation along $M' N'$. The rotation of the straight-edge about any point in the plane of the wheels is not taken cognizance of by the latter, while the motion of translation in the plane of the straight-edge causes all wheels to revolve through the same arc. Any movement, however complicated, of the straight edge upon the paper must be considered as made up of rotations and translations as described; therefore, the wheels being set to indicate similarly in the beginning, it is impossible to move them out of these positions of coincident readings.

In Fig. 3 let F be the tracing point; P the fixed point or pole; G the joint; M the measuring wheel. $M N$ is the trace of a plane coinciding with that of the wheel, and $P N$ a perpendicular upon it from P. Now let F be moved to the right length, $P F$ remaining constant. Every point of the system will then describe a circle about P, and all relative distances, $M N$ among them, will remain constant. The measuring wheel M will therefore, as in the case of the wheels on the straight-edge, revolve similarly to an imaginary one at point N. As the latter remains tangential to its circular path, it follows that the arc s, measured by it, as also by the measuring wheel M, is equal to the circumference of a circle of radius $P N = p$; *i.e.*, $s = 2 \pi p$.

The measuring wheel will revolve right-handed, as seen from F; for the reverse direction of the motion of F the direction of rotation of the wheel will likewise be reversed.

The value of p is readily obtained from the right-angled triangles $F P Q$ and $G P Q$. $F G = a$, $G M = c$, $G P = r$, $F P = R$.

$$P Q^2 = R^2 - (a + c - p)^2 = r^2 - (p - c)^2$$

$$R^2 - a^2 + 2 a (p - c) = r^2$$

$$p = \frac{a^2 + 2 a c + r^2}{2 a} - \frac{R^2}{2 a}$$

$$s = 2 \pi p = \frac{a^2 + 2 a c + r^2}{a} \pi - \frac{R^2 \pi}{a}$$

For another circle of radius R' described by the tracing point, the arc registered by the measuring wheel s' is, similarly—

$$s' = \frac{a^2 + 2 a c + r^2}{a} \pi - \frac{R'^2 \pi}{a}$$

the lengths a, c, and r remaining unchanged. If now, in Fig. 4, point F is moved over the outlines of the ring, 1 2 3 4 5 6, the movement of F will be right-handed over the outer circumference, and left-handed for the inner, while the crossing of the ring radially takes place twice, and in opposite directions, and is therefore without effect on the final reading of the wheel. The direction of rotation of the wheel being right-handed for s and left-handed for s', the arc registered will be $b = s - s'$. Substituting the values of s and s' found above, we shall have—

$$b = \frac{R^2 \pi - R'^2 \pi}{a}; \text{ or } R^2 \pi - R'^2 \pi = a b.$$

The left side of this equation is the area of the ring $= f$; hence we obtain the simple relation $f = ab$, *i.e.*, the area of any ring whose center is P is equal to the product of the length a of the movable arm by the arc registered by the measuring wheel.

It is manifestly immaterial at what point we cross the surface of the ring, the motion of the wheel being right-handed or left-handed, according as the tracing point is moved from the outer circumference inwardly, or from the inner one outwardly. If point F is therefore made to move over the outlines of the ring segment $F 1 2 3 4$, Fig. 5, the movements of the wheel due to the radial lengths 23 and 41 will be equal and opposite, and the arc registered will be one $n'th$ of that registered before, supposing the subtended angle to bear this ratio to 360°. Both sides of the equation $f = ab$ have therefore been decreased in the same ratio, a remaining unchanged, the equation still holds, and the area of a ring segment likewise is equal to the product of the movable arm of the instrument by the length of the registered arc.

If now a figure, Fig. 6, composed of any number of annular segments whose common center is P is run over as indicated by the arrows, we shall obtain the area as for the single segment. The result will evidently remain unchanged if we omit all lengths which are traversed twice in opposite directions, leaving only the outlines of the figure. The number and size of the elementary segments is a matter of indifference, and as any figure may be considered as made up of segments infinitely small, it follows that in general the area may be found, according to the formula $f = ab$, by moving the tracing point F over the outlines of the figure, the only condition being that the instrument must be brought back to the position from which it started.

As the length $P G = r$ of the guide arm does not enter into the result, it may be made of variable length or even infinite, by guiding G in a straight slot. This form of the instrument is identical with what is known as *Coffin's Averaging Instrument*. To convert a figure of area f into a rectangle $l \times h$, *e.g.*, to find the mean pressure of an indicator diagram, it would be convenient to make the length of arm a equal to that of the diagram; then $l \times h = f = a \times b$; and as $l = a$, we have $h = b$.

If the area to be measured is too large for the instrument, the pole being outside, we must either divide it up into sections, or else place the pole within the area to be measured. In this case it is necessary to omit that portion of the surface immediately surrounding the pole, and take account of it separately. The process is somewhat tedious, as the tracing point must be moved over the outlines of the figure, over those of the portion omitted, and twice over the radial length connecting the two (see Fig. 7). However, the process may be simplified by making the area omitted such that the wheel will not turn while tracing its outline. This is a case for a circle whose center is the pole and whose radius R is such that the p corresponding is zero, the plane of the measuring wheel passing through the pole (Fig. 8). For $p = o$, we have, as found above:

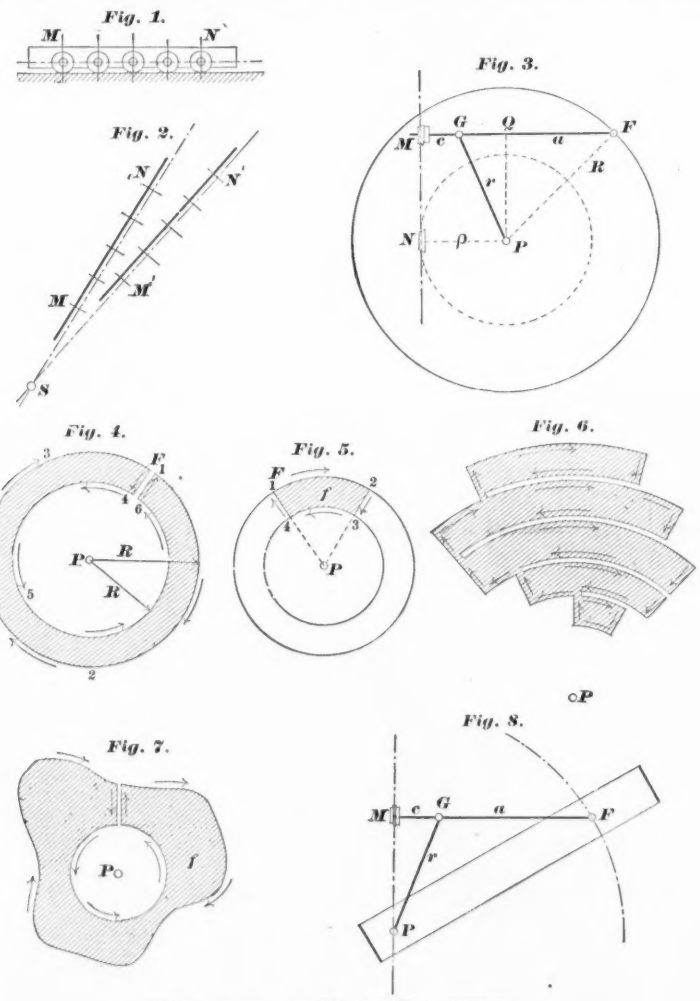
$$a^2 + 2 a c + r^2 - R^2 = o,$$

and the area of the omitted portion is

$$R^2 \pi = (a^2 + 2 a c + r^2) \pi$$

To find the area, therefore, the pole being inside, proceed as before and add the constant $(a^2 + 2 a c + r^2) \pi$.

It was stated above that for measurements with the pole outside the result was independent of the length r; it may be added that it is likewise independent of c. Any motion of the measuring wheel in the direction of its axis, due probably to readjustment of its bearings, will therefore have no influence on the readings. For measurements with the pole within the area it is important, however, to check the accuracy of the constant. To this end place the points P and F of the instrument upon a slip of paper, Fig. 8, so that the pole P is as nearly as possible in the plane of the wheel. Now rotate the slip, keeping its tension constant, about pole P, and notice if the wheel turns. According as it turns in one direction or the other, $P F$ is increased or diminished, until no motion is perceptible. The area of the circle of radius $P F$ is the constant required.



THEORY OF THE POLAR PLANIMETER.

An Ogden (Utah) dispatch says: Joseph Clark, representing an English syndicate, has bought twenty-three, or all but six, of the flour-mills in Utah. The transaction involves $1,800,000 for the plants, and $350,000 for stock now on hand. The company proposes to erect a number of elevators, and expects to control the entire wheat crop of the territory. The mills purchased by Mr. Clark have a capacity of 2,024 barrels of flour per day.

Steam Boilers and Steam Pressures for High-speed Steamships.

BY OBSERVER.

The weight of marine engines and boilers per indicated horse-power has been greatly reduced within the past twenty years, the engines, as a rule, more than the boilers.

For a pressure of 170 pounds per square inch we must have a thick shell, thick heads, and thick furnace tubes, when the boiler is of the fire tube type, and this gives a heavy boiler, but of less weight in proportion to power transmitted than those of the days of the two-cylinder compound machine.

Water tube or sectional boilers have been and are still made, that carry with safety 200 pounds per square inch in land engineering, but except for torpedo boats, launches, yachts and other small vessels, they have taken no place in the marine engineering world.

There appear to be several reasons for the non-introduction of water tube boilers in large sizes for sea service. From 1858 to 1866 the Martin water tube boiler was used in the U. S. Navy, and one ship (the Algonquin) in this service was fitted with a boiler designed by the late E. N. Dickerson, having inclined water tubes surrounded by a rectangular shell; 90 pounds' pressure was carried on the boiler at sea.

The water tubes in the Martin boiler were short (about 3 feet long), and vertical; the limit of pressure was 65 pounds; the usual practice with this type was 45 pounds.

A marine boiler for high steam pressures must have great stability against twisting strains, as well as pressure. The tubes and their receiving heads or connections must be kept in alignment with each other, otherwise leakages will develop rapidly, and a series of boiler leaks at sea is a constant source of danger.

All water tube boilers have a tendency to prime or foam, as the ascending currents of steam escaping from the tubes must carry a larger portion of moisture than the return fire tube boiler, with large water line surfaces.

Of late, most of the builders of land water tube boilers have increased the diameter of the combined water and steam chambers placed above the water tubes, and have thus prevented excessive priming.

The average water tube boiler is a high duty evaporator, owing principally to swift circulation, and nearly all of them will show an evaporation of 10 pounds of water at and from 212°, with one pound of fair grade steaming coal.

The combustion chambers should be large, and of forms that induce good results in burning fuel of all kinds.

The strength of the usual types of water tube boilers is sufficient for any desired pressure for motive power on land, but their durability is not equal to the ordinary horizontal return multitubular boiler. A great amount of time and money has been consumed in attempts to make a real practical working marine water tube boiler of *large* capacity; but, as yet, the grand result has not been reached. The main mechanical difficulties (leakage and excessive repairs) still exist. A multitude of ground and screwed joints cannot be relied on at sea. Small water-ways are sure to be forced dry by hard firing, and thus burn away the metal. The tubes next to the fire are liable to become coated with impurities in the water, and waste away on the outer surface, from their close contact with the impinging heat of the furnace.

It has often occurred to the writer that the enlargement of the two lower rows of tubes of the ordinary inclined water tube boiler would add to their life materially; for example, make the lower tubes 7″, and the others 4″ or 4½″ diameter.

Although the internally fired fire tube boiler in marine form has many defects, it still holds the lead for this service. True, the factor of safety is low compared with the water tube type, yet it is the *safest* boiler at sea.

It has small combustion chambers, there being very little space over the fire bars, and not, by any means, enough in the rear of them.

Some of the water-ways are very difficult to reach in cleaning, and in many cases the fire tubes are too short for effective work; yet, as I have intimated, this style of marine boiler is the most economical in every way for marine work. We hardly know to-day to what extent the steel alloys can be used in boiler plate, but we do know that it would be a great step in the right direction to be able to reduce boiler shells from a thickness of 1¼" to 1", and still retain all the qualities for working without injury in the boiler shops.

When we think of the vast number of steam boilers afloat, and that four-fifths of them are practically from one design, we may well pause to inquire into the reasons for this similarity of construction; the writer has, therefore, endeavored to call attention to what he considers some of the reasons.

Candidly, we think the inventor and builders of water tube boilers have a great field before them, because a boiler constructed on this principle is certainly needed to furnish the missing link in the chain of invention that is to bring us to the 25-knot era. They should try to reduce the number of parts that are now in nearly all cases bolted or clamped. They must provide large water-ways near the fire, and the whole structure must be campact and self-contained. Experiments in large marine work are very expensive, and, of course, builders are slow to undertake them. The U. S. Navy is in need of a strong high-pressure boiler to-day, and we think the government should enter upon a series of experiments, with a view to the final production of a practical marine *water tube* boiler.

The "Ideal" Drawing Stand.

We give with this an illustration of a drawing stand which seems to combine the desirable features in such a structure, being neat in appearance, convenient to adjust, and absolutely rigid in whatever position it may be placed.

The board is raised or lowered by means of the foot treadle seen in front, and is supported by dogs, which engage with the teeth seen on the inside of the standards. The table can be inclined to any desired angle, and when adjusted is held in the desired position by positive locks, so that, if the full weight of the draftsman happens to come upon the board, no change of position results. The dogs are disengaged for lowering the board by means of the cord shown in front. When the board is in its lowest position the foot treadle folds up out of the way. There is a bracket for holding inks and the tool tray, and the stand is easily moved about upon the casters with which it is fitted. The stand was designed and is manufactured by W. S. Rogers, of Troy, N. Y.

THE "IDEAL" DRAWING STAND.

A Turret Tool.

BY A. D. PENTZ.

It seems well that the small tools of this period should be illustrated and accurately described. It is not likely, but possible, that we are on the summit of American mechanical progress, and that the future lies downward. If so, it is the right thing to set forth in some shape what we are doing, and what it is being done with. If not so, our descendants and followers should have an opportunity to see where we stood at this time, to compare progress and form opinions of how little or how much we know.

It is not believed that the state of the arts in the last half of this century will ever be despised. It may be that greater progress will come even at a more rapidly accelerated pace; but the age of the telegraph, electric light, the telephone, and of the supersedence by tools operated by power of those held in the hand, will, it is believed, be like the Elizabethan era of English literature—a criterion for comparison.

The most interesting things to the student are not ancient ceremonies of state, nor the record of the overcoming of a weak people by a stronger one. The handiwork on an arrow-head or a stone axe, however, is eagerly examined. Methods of getting and of preparing food, and their tools for every purpose, tell how much a people have advanced beyond the savage state, and are open books to every eye that beholds them.

What the arts owe to Egyptian records is not known. Many doubtless have been lost and re-discovered, but this marvelous people became civilized, saw the possibility of a future state of barbarity, and cut their arts into enduring stone. A few days ago I read of the discovery of a door bolt found in an ancient granary in Egypt which was operated precisely like the Yale lock.

Two hundred years is a short time ago in England, and the strongest light of history, which a despotic king could not cover, shines on the reign of Charles II. Still a record of every day life, and what one man, Pepys, saw, experienced, and knew of, is acknowledged to be of more real historical value than all other contemporaneous records. It is the common things of our time, those that have a common place in the experiences common to all people, which will appeal to the interest of common people in after times. It is the common tools which come into contact with the metal that will interest our followers more than our ponderous engines of power, or the ingenious aggregations of specialized motions, which interest this generation so greatly. There is but little danger of the famous machines of any age being either lost, forgotten, or of their retaining a particular form any length of time; but there is scarcely a shop anywhere, no matter how small, that does not contain a tool which exhibits an idea that does not exist in any other place in the world, and a record of them, if made, would preserve them. Now the association of large interests and means, of both capital and labor, which is illustrated by the tendencies of the age, will prevent the successful establishment of many new small shops, and will ruin many of those now existing. This tendency to some extent will withdraw the incentive to American invention in shop tools, by making hopeless a realization of the benefits to the inventor, and until the mechanic arts shall be established on an entirely new basis of mutual benefit there will not again be as much of this characteristic ambition of American workmen as heretofore, when he got the benefits himself.

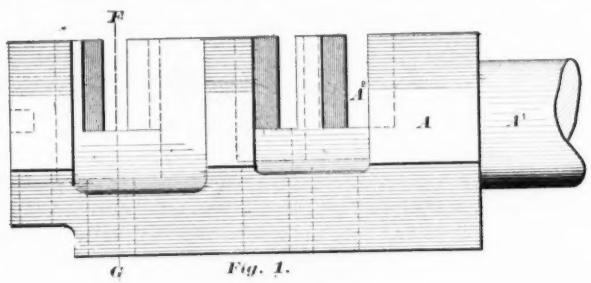


Fig. 1.

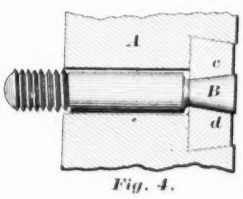
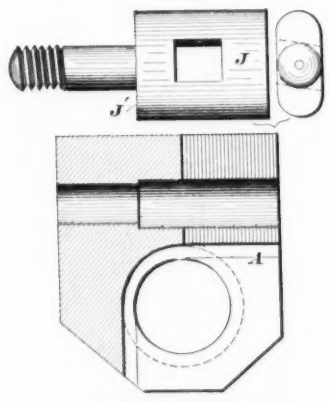


Fig. 4.



Section E G
Fig. 2.

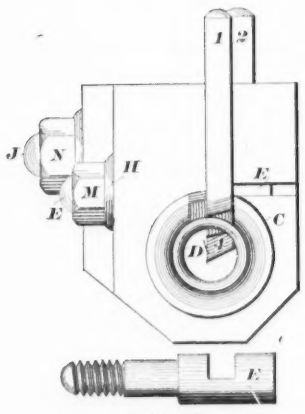


Fig. 3.

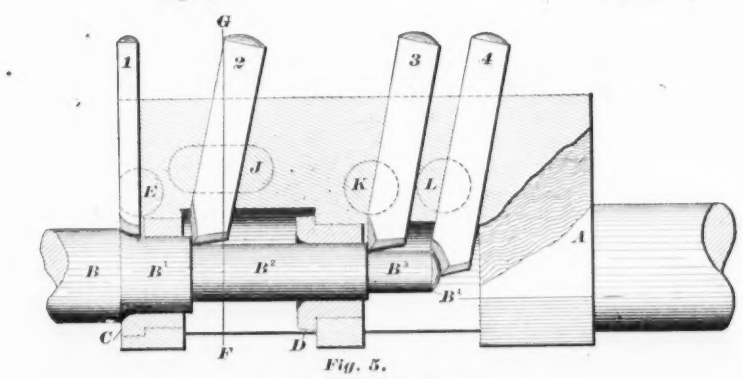


Fig. 5.

A TURRET TOOL.

In Fig. 1 is shown the stock *A* of a "box tool" for a turret machine. In this figure it is shown alone as finished to receive the other parts. The tool slots are shown to be cut down from the surface, and not, as usual, mortised through. The first operation after turning and fitting the stem, tang or shank *A'* to the turret is to plane the piece to shape, which planing need not be very close necessarily. Then a suitable block of casting should be placed in the chuck of a lathe and bored out just so that the stem *A'* shall quite tightly fit it its whole length. Then the hole as large as the outside of the bushing *D*, Fig. 5, is bored to the wall A^2, Fig. 1. It is then enlarged to the size of the bushing *C*, Fig. 5, as deep as the position of the shoulder of the bushing *D*. Additional enlargement between the bushings is optional, and is only necessary when the cuttings from the tool 2 require room. The "boxes" should be opened in a shaper, as a milling machine will leave or make troublesome corners or marks; besides, a shaper will do the work more quickly. The slots for the cutters 1, 2, 3, 4 should also be made on the shaper.

Fig. 2 shows a section indicating the shape of the box through *F*, *G*, the recess for the clamp bolt *J*, and the bolt *J* enlarged.

Fig. 3 is an end view of the tool, showing the parts in position. The clamp bolt *E* for the cutter 1 is also shown. It will be seen that the bolts *E* and *J* are made differently. *E*, of course, is the cheaper, and it is a very good clamp. Ordinarily such tools are mortised and the cutters are held by set-screws, but such mortises are expensive and difficult to locate in comparison with the slots The cutters 3 and 4 are held by bolts like *E*. In Fig. 4 is shown still another method of holding two cutters by one bolt. In this case the bolt *B* is loosely fitted to the part *A*, and clamps the two cutters *c* and *d* by forcing them into angles as shown. All these bolts are tightened by nuts like *M* and *N* in Fig. 3.

Fig. 5 shows the stock *A* in section, with tools adjusted to make the stud *B*. The bushing *C* is tightly fitted to the stock *A*, and the cutter 1 is set just so that its edge extends beyond the curved entrance to the bushing a trifle, but is adjusted so that it cuts the stud *B* in diameter to fit the bush-

ing *C*. The cutter 2 cuts the body of the stud, the cutter 3 reduces it for its threaded end, and the cutter 4 rounds the end. These cutters are placed inclined, for the purpose of giving the grinder an advantage in sharpening them. They are intended to be made from bar steel and not machined at all before they are hardened.

In making a stud like *B* from a bar of machinery steel, care must be taken to have the bar end run as true as possible before commencing to cut to precede this tool by a "pointer," which rounds the corner of the end so that it, when it enters the bushing *C*, shall not have a tendency to disturb the alignment of the box tool, or to injure the cutter 1; and to have sufficient oil. There is no oil that is as cheap in the end as pure lard oil. Do not force the cut. A tool of this kind is a willing device when properly adjusted, and will invite crowding beyond the ability of the cutting edges to maintain sizes, but the time lost in grinding and setting tools will more than eat up the extra work gained. The gait of best economy will soon be found by experience.

it will be found an improvement over the dog for similar purposes.

No. 5, a holder and clamp for securing driving brasses while being planed on the cage.

No. 6 shows the most accommodating bolt in the world. I am extremely sorry that its application cannot be extended to other tools than the drill. This beautiful and much sought bolt will, no doubt, be understood by the drawing.

No. 7. Considerable ingenuity has been expended upon machines and devices for boring car brasses (by the way, the U. P. R. R. do not bore them at all, but grind them in a holder on a speed lathe); but this arrangement I suggest pertains to boring on the half-shell, with double or triple cutters on a boring mill, milling machine or lathe, as suits the facilities. The cutters are threaded and screwed into the body, set-screws are provided on the side to keep them from turning. When cutters are ground below size they may be unscrewed a turn and the proper diameter renewed. The arrangement of work, as shown, has the advantage

in a bar, the pin, of course, being taper, and a niche cut in the cutter to correspond. This is particularly convenient when using Mushet steel for cutters, as simply a nick ground for the pin insures the cutter coming central.

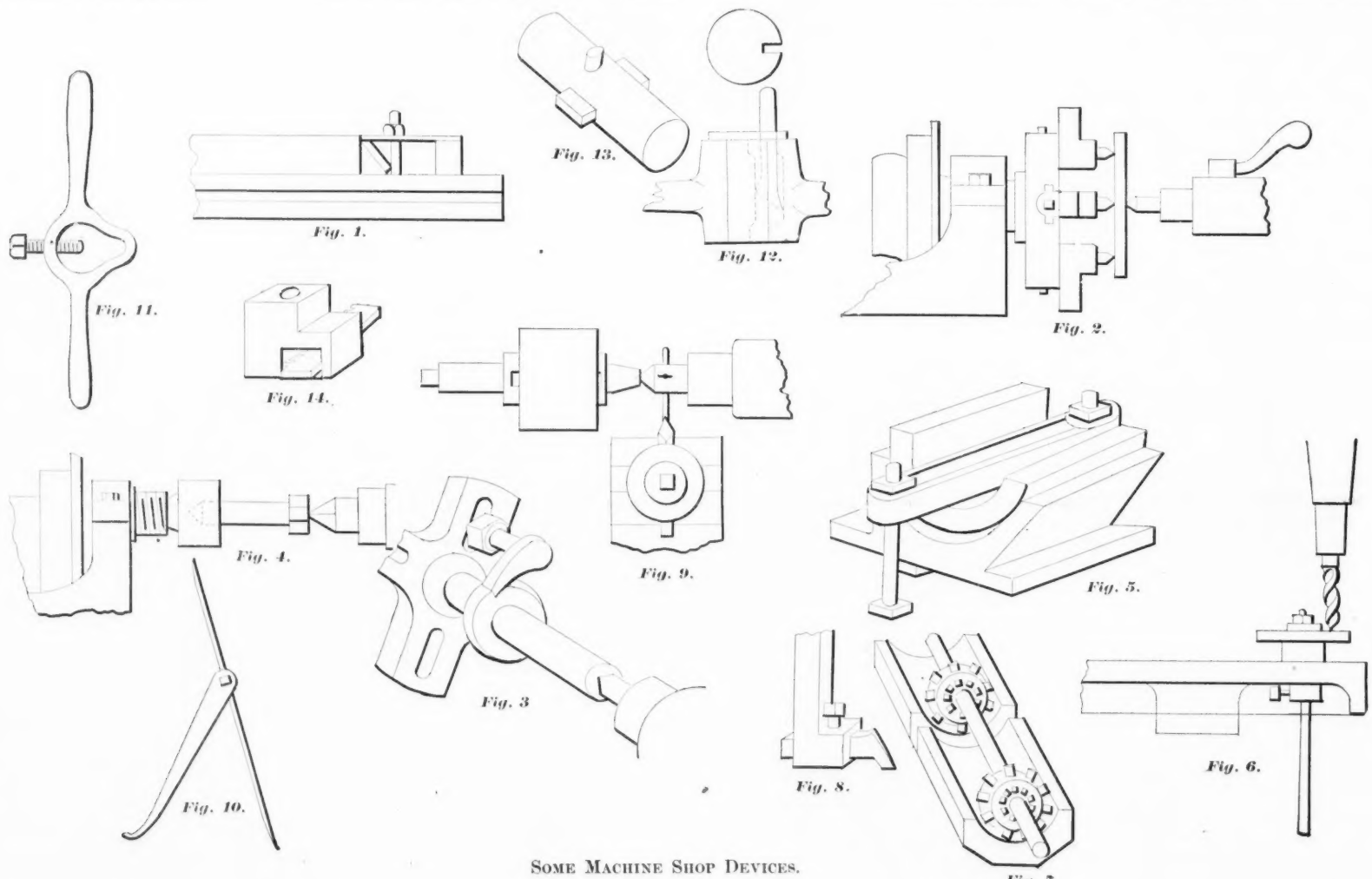
No. 14. This is what the U. P. boys call a stud remover. It is used mostly on steam chest studs. The notched key is inserted in either side of block, so as to pull on.

No. 12 shows a small device for cutting oil grooves in pulleys, etc., consisting of two pieces, a chisel and guide plug, also a hammer to drive it. The plug is slotted; in the slot a rise is provided the length the groove is to be, the chisel is made the width of the slot with a projecting cutting edge, also a projecting heel. The chisel starts in somewhat below the edge of pulley hub, then by the projections is advanced into the cut, following the proper depth downward until released by the lower offset, when the chisel recedes and the whole thing comes out freely, leaving a groove in the hub without coming out at either edge.

L. C. SHARP.

finite changefulness of dimensions, form and color, under the action of heating and cooling, furnish to the close observer a safe and thoroughly reliable key to proper treatment of all the "different steels." The statement that "there is more carbon in what appears to be almost carbonless iron and steel than is commonly supposed," may be true. If it be true, when is the important knowledge to be imparted of "about" how much the ignorant public are "off," in their carbon percentage reckoning?

"*About* 2 per cent. of carbon, and *about* 98 per cent. of iron (*about* being used in the sense to mean ½ of one per cent., or 5 per cent.)" Great Scott! And with this statement as a "didn't say so," comes a slap at "rule-of-thumb steel workers." "20 or 500!" "*About!*" What an "*about*" this is, to readers of the AMERICAN MACHINIST, who are, through the use of modern appliances for measuring, working daily to within limits of fractions of thousandths of an inch, and in their treatment of steel have learned that a variation of so little in per cent. of carbon as .05 in .75 to 1.00 is often



SOME MACHINE SHOP DEVICES.

LETTERS FROM PRACTICAL MEN.

Some Machine Shop Devices.

Editor American Machinist:

I send herewith inclosed rough sketches of several devices which I have found to be quite serviceable. Perhaps among them some of the readers may find something which may offer a suggestion.

No. 1 is a side hill clamp, showing a convenient way of securing a clamp at the end of flat work.

No. 2 shows three pins set in the jaws of a chuck, intended for driving a plate while being turned off the outside. After being turned it may be placed in the chuck and faced off, also long cylinders may be turned their full length, and without fear of springing. If thought desirable, three angle irons, with centers inserted, could be bolted on the face plate instead, thereby saving the inconvenience of drilling the chuck.

No. 3, an excellent driver for the bolt lathe. The head of the bolt is nicked to receive the driver. This expedient allows a bolt to be finished quite up to the head, then reversed and the head finished.

No. 4 shows a female center, with teeth like a reamer cut inside—the object of which is to drive bolts for square centering; of being easily set, and the duty on the cutters is not severe.

No 8. Another slotter bar.

No. 9. No doubt there are many who have a large number of similar pieces to turn in the lathe. It is evident that almost as much care must be exercised in starting a roughing cut as one to finish, lest too much be taken off. In order to facilitate this work so far as possible, I have made an arrangement as shown, which is simply a piece of wire run through the center as near the spindle as possible. A small thumb-screw or binder is shown to bind the wire in any position, or diameter rather. In operation, first turn one blank, then run the tool back opposite the wire, set the wire out until it touches the tool. The tool may now be taken out and ground any number of times, and set back to its original position. On some classes of work it may be used entirely dispensing with calipers; the idea should be readily understood by the sketch. The mandrel shown is the Nicholson expanding.

No. 10 shows a fancy in calipers, one wire leg reversible, giving several tools in one.

No. 11. A convenient wrench for the link bench, for grinding and turning pins.

No. 13. A good quick way to fasten a cutter

The Treatment of Steel.

Editor American Machinist:

From the tone of the article in your issue of January 7, 1892, under the heading, "An Interesting Experiment with Steel," it appears that the author of it, and of a former communication under the same heading, is not only scientific in the direction of analysis of iron and steel, but is a humorist of such ability as should make Mark Twain and Bill Nye look to their laurels. Really, he is immensely funny! "Chase a jack rabbit across the prairie?" Yes, if I can get any new light upon the steel question which can be made apparent to the comprehension of ordinary mortals. The particles discovered by the author of "An Interesting Experiment with Steel" may be "invisible under the most powerful microscope," and, if so, I would like to learn by which of the senses our volunteer instructor in the higher branches of steel lore has become so well informed as to their presence and transformation under the action of heating and cooling, from "comparatively large particles" to dimensions so small as to be invisible to the eye, either with or without spectacles, or even under the most powerful microscope. Yes, I plead guilty to the charge of writing about the "particles" which I can see. I contend, also, that these particles, in their infraught with most dire results! Twenty against five hundred! Nearly twice the per cent. of carbon in the maximum figures which the boldest claimant for high carbon steel dares to offer! Of course, the dullest man, or boy, in the great army of American machinists would enter a protest against a possible 96 per cent. reduction in wages. "*About* 10", meaning 1" or 25" !" Who said, "It's fatal to explain"? 4th, 3d, 2d, 1st, brings us to "wall trimming" as we go up. This is too much for me. I don't understand what is meant, any more than I did the "real characters of the word picture." "Pleasure in misunderstanding?" No, sir. You wrong me. I simply sought to prevent, so far as my feeble efforts went, the absorption by the confiding steel working public of another heresy, steel wise, of which there were already too many. I thought "2 per cent. carbon in steel wire nails, or iron cut nails," was carrying the thing too far, but am told now that, under the proper interpretation of the author's meaning, *i. e.*, with due respect to the word "*about*," it might have been read 5 per cent. Of course, the explanation that this was simply "filling-in material" ought, perhaps, to be accepted as ample excuse for the apparent inaccuracies.

Now a word to the boys about so treat-

ing steel as to have the "particles," which can be seen, show up the fine, uniform grain so much admired, whether in the hard condition resulting from working, forging, the soft condition following annealing, or, most important of all, the hardened condition.

1st. Don't be afraid to heat to a good mellow heat for forging when considerable work is to be done.

2d. Don't terminate working at a high heat, but continue the working down to low red heat, not black. This refines by working.

3d. Don't heat so hot for annealing as to open the grain and thereby defeat the enjoyment of good gained by proper forging. Under proper conditions of heating and cooling, steel can be thoroughly annealed at no higher heat than that at which it would refine in hardening. Heat slowly, evenly, and heat through. Be sure to let the cooling down be very gradual; especially, don't commence cooling by putting into something cold, whether charcoal dust, ashes, sawdust, lime, or other convenient material. In cases of small pieces this is fatal.

4th. In heating for hardening, be very particular to let no part of the piece get too hot.

In hardening dies, milling cutters and the thousand and one other tools having projecting angles which are liable to crack off in hardening, the most prolific source of trouble is in the too quick heating of the corners or lighter parts, these getting really too hot for dipping, while the heavier parts are not yet red.

Does somebody ask, "What's the odds, when we let the too hot parts cool down so that, on dipping, the heat is even?" All the difference in the world, boys. By this difference in heat has been established differing condition in the parts, so that on dipping there is not only the natural antagonism of forces attending unequal contraction as between large and small parts, but there is a superadded, intensified strain, from the fact that overheating some parts has really, for the time being, transformed them into a practically different material. Don't dip a piece so heated. The mischief is done for that particular heat. Do what, then? Heat evenly, all through, to right heat for dipping, and let cool off as for annealing, then repeat for hardening. S. W. GOODYEAR.

Boring by a Drawing.

Editor American Machinist:

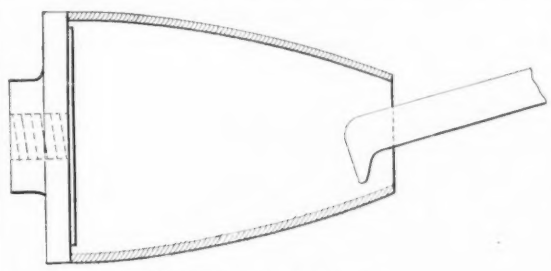
Some time ago the foreman came to me with a brass shell like the sketch, to be bored out. Now what seemed to bother me most was how to chuck it so as to get a good smooth job and be able to caliper it. I might, of course, have bored out a wood chuck and driven it in, but how could I measure the thickness? Well, that job put me onto a kink that has stood me well in many a difficult place since. I got an old flange and fit to the spindle of the pile of cast-iron we called lathe (it was a small foot lathe of antediluvian date, rigged for power, with gears and feed screw of another lathe), so you see I was fixed. I faced enough to get a good seating to solder the shell after cleaning the large end. I stuck it in a few places, then I trued the shell while running; then I soldered permanently. Now, as you see, I have a small hole to work through, and am ready for a drawing full size; this I fixed on a board which is held on the shears, so it cannot move. I then fixed a scriber to the cross-slide; then moved the carriage and cross-feed so that the scriber commenced at the small end of the drawing, and fixed the tool in the post, just scraping at the same place on the casting. Now you will perceive that I cannot move the tool without moving the scriber in the same way, and *vice versa*. If I move the cross-slide and carriage so that the scriber follows the diagram, the tool will turn the casting exactly like the drawing, no matter what shape. This little trick has saved me and parties for whom I have worked at different times many hours previously spent in template making. This shell was to be $\frac{5}{32}$ thick; it was reeded on the outside.

J. H. TAYLOR.

The Treatment of Steel.

Editor American Machinist:

Mr. Goodyear's article, under the head of "More About Steel," in your issue of December 3, leads me to almost believe him to be the very man I was looking for, viz.: "One who really knows." At any rate I should be willing to accept him as such if he would only adopt my *little treatise scheme*, and give up his notion about removing *all sorts* of articles from the cooling bath before they are thoroughly cooled. In my former article, to which he refers, I merely remarked that classifying the steel according to price would be better than calling it simply steel, and I think so still; for if the inexperienced was told that a piece of steel costing but three cents a pound was unfit for



BORING BY A DRAWING.

a milling cutter, he would know better than to use it for such a purpose, whereas he would not if simply told that milling cutters were made of steel.

But I immediately added that no doubt a much better method might be devised, which last was omitted, presumably as superfluous, as the method of classifying was to be optional with the writer of the proposed article, whoever he might be.

It is no doubt true, as Mr. Goodyear states, that a great many steel users are paying a much higher price for their stock than is necessary, but I hardly think that any of them pay fancy prices for fun, but simply from the lack of the very information that I asked for, *i. e.*, What is the best steel to use for certain *common* purposes, from a *commercial* and mechanical point of view? and it seems to me that a few hints about how to use it would not be amiss, in view of the *bad luck* (I call it so from courtesy) of Mr. Goodyear's neighbors, which I freely admit is *not* unusual as practiced by a great many. It is a notorious fact that a very large percentage of otherwise good machinists are poor temperers, and this is why I ask for more light.

I am a firm believer in the doctrine of experience, and know that it is absolutely necessary as a finish to one's education; but, as I said before, we must first learn the language of steel before we can understand its needs, and this can be learned from some one already familiar with it, at a great saving of time and material. There are numberless mechanics who look to the AMERICAN MACHINIST for just such information, and therefore I think it would be in order to have a few *cold facts* upon this subject, and right here I would like to say, let us be warned by the prevalence of quackery in medicine, and discourage it as much as possible in mechanics.

In regard to the lack of uniformity in given grades of steel spoken of, I am glad to note that this is growing less every year, especially in the American product, and while we shall probably always have the errors and misfortunes of the steel maker to contend with, still I think that certain brands of steel can safely be said to be adapted to certain purposes.

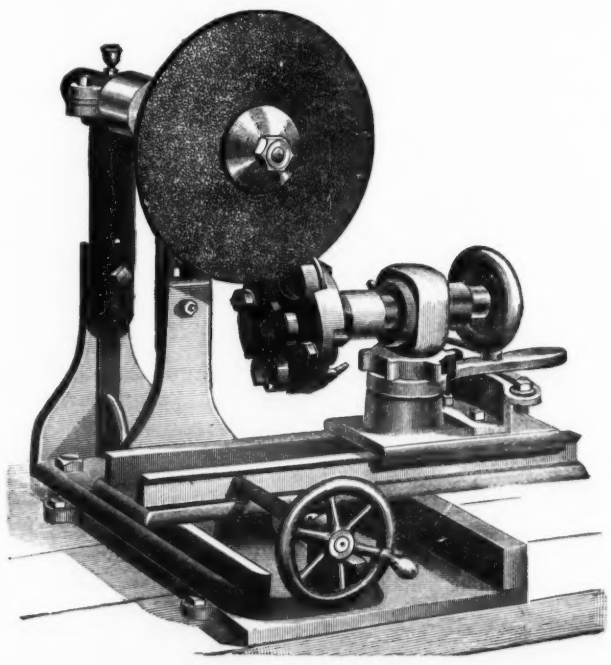
I understand just how easy it is for the specialist to obtain the kinds of steel adapted to his work, and I also understand how hard it is for the jobber to obtain, and always have on hand, a stock of steel especially adapted to everything which he is called upon to make.

Mr. Goodyear misconstrues my remarks regarding loss from removing some articles made of some grades of steel from the cooling bath before being thoroughly cooled. I did not refer to the danger from cracking, for I consider that this trouble is almost entirely due to the treatment the steel gets *in the fire*, and not in the cooling bath, providing enough of the cooling medium is used.

There are other things to be taken into consideration. Let me illustrate: Suppose I am called upon to make, for immediate use, a stamping punch similar to those used for stamping coin, and I find upon looking the stock over that the "*old reliable good-for-everything*" is all out, but I find a piece of rather low grade steel, which, by very careful treatment, I can use. Now if I harden it according to Mr. Goodyear's method, will he be kind enough to guarantee that it will not *faint away* under the excessive pressure to which such punches are subjected? I am aware that the one-inch cube will not be as hard in the center as on the outside, but if properly treated I doubt if it can be either drilled or cut with a chisel to any great extent; but if treated according to his method the inner portion will be annealed according to his own definition, *i. e.*, "compelled to cool off slowly," and, of course, it is well known that a piece of steel with annealed center will not be equal in compressional resistance to a piece that is made as hard as possible throughout.

Speaking of the treatment of steel, Mr. Goodyear says "it is very simple"; so is the Greek language to one who has mastered it, but it is rather blind to the novice; and so is the successful treatment of steel for all purposes simple, I will admit, compared with what some would have us believe, but compared with rolling off from a round log, no. There are a great many opposing forces to contend with, and to be successful we must not only be familiar with all the points about steel which Mr. Goodyear has such a happy faculty of introducing into his articles, but we must be alive to all the special local conditions and requirements of the job on hand, and exercise "eternal vigilance."

J. N. SEVERANCE.



SHIMER HEAD GRINDER.

One and Two-tooth Pinions.

Editor American Machinist:

I picked up an old issue of the AMERICAN MACHINIST, May 21, 1891, this morning, and was interested in reading the letter from Benj. F. Wilson, about his *one* and *two*-tooth pinions.

I want to express my sympathy for him. If Mr. Cooper adopted his single-tooth "movement" without giving him due credit, Mr. Cooper should do so yet, and very possibly Mr. Wilson will receive a substantial acknowledgment some time. Still, from personal experience I must say candidly I would not bank much on it. If it was interesting to the general reader I might perhaps write you out a short article of six or eight columns on "man's ingratitude to man," in the matter of the cable motive power on the Brooklyn Bridge; but as *one* of the pirates, if not *the* pirate, is now dead, and therefore unable to defend himself, I will forbear. Yet it is humiliating to realize that every once in a while some of us smart chaps "get left," both in money and, to what is equally dear to a good mechanic, the honor and glory.

Now I don't wish Mr. Wilson to think I am taking any glory from him when I say that about 1864 or 1865, Seth Boyden, whom everybody in this part of the world has heard of, came into the shop where I was serving my time, and explained to my boss, in my presence, the identical *two*-tooth pinion shown by Mr. Wilson, Figs. 1 and 2, in the issue referred to. I made a note of it at the time, and think I now have a sketch of it. The fact that Mr. Wilson developed his idea in Canada, and Mr. Boyden developed his idea in New Jersey, although at about the same time, rightfully entitles each, I think, to due credit.

OROSCO C. WOOLSON.

Shimer Head Grinder.

With this we present an illustration of a machine made especially for grinding the bits of shimer heads or other similar work on wood-working machinery.

As will be seen from the engraving, the machine consists of a head supporting the emery wheel arbor at the top in such a manner as to be adjustable, and below this a head on which is supported an arbor to which the shimer head is secured. This arbor can be raised or lowered for adjustment by means of a thread cut on the shank, and can be turned at any desired angle and clamped. When adjusted properly it is only necessary to bring the bits one after the other into position by revolving the arbor. They are ground by moving the carriage by the hand wheel shown. This insures uniform work, and, of course, the work is very quickly done, all the difficulties met with in grinding such bits by hand being entirely done away with. The machine weighs 420 pounds, or, without the table, 200 pounds. Its height from the table to the center of the spindle is 17″, and from the floor 45″. The emery wheel used is 10″x$\frac{3}{8}$″. There is a countershaft with T. & L. pulleys for a 3″ belt, and it should run at a speed of 370 revolutions, giving the wheel a speed of 1,900 revolutions. It is made by the Springfield Emery Wheel Mfg. Co., Bridgeport, Conn.

The burning of the works of the Waterbury Brass Company shows the dual effect of such a catastrophe. Not only is there a loss of $200,000, but 250 men are thrown out of their regular employment, many of whom have families to support.

The editors of the AMERICAN MACHINIST have received from Thomas D. West a regular check for "one thousand kind wishes," which is fully appreciated.

AMERICAN MACHINIST

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Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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NEW YORK, JANUARY 28, 1892.

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Do You Read Your Trade Journal?

We have a letter from the proprietor of a machine shop in New England, in which he says: "It is always a source of regret to me that not one of the men in my shop reads any mechanical journal, or seems to think of his business after six o'clock. Sometimes I do not wonder that I cannot raise their pay."

There is a good deal in this that is worthy of consideration by any mechanic, young or old, experienced and skillful or inexperienced and with much yet to learn. This proprietor does not mean, of course, that if his men should take and read a mechanical journal he would be able to immediately raise their wages, but he means that the fact that they do not take interest enough in their chosen life's work to think of anything pertaining to it outside of working hours, nor to read a paper in which other workers in the same field are recording the results of their experience, shows plainly that they are devoid of that ambition and interest in the affairs relating to their business, without which any mechanic is at a great disadvantage. It does not, of course, follow from this that every machinist who reads such a journal as this is better than any other machinist who does not read it, but it is quite certain that, no matter how good a workman a man may be, he will be a better one, if, in addition to his natural ability and efforts to excel, he also sees to it that he gets the benefit of all the experience of others in the same line, so far as it is obtainable; and this he can only do by reading the best journals pertaining to his trade.

It is not the thinking of their work after six o'clock nor the reading of mechanical journals that directly causes men to prosper in mechanical pursuits, so much as it is the spirit that prompts men to do these things. If a man is really interested in his work as much as he should be, he will, in spite of himself, think of matters pertaining to it after six o'clock, and he will not be content to know nothing of what is going on in other shops and in other places where work similar to his is being done. And it is this lively interest in his business which will sooner or later distinguish him from those who take no interest in it; and, other things being equal, he will go beyond them.

A proprietor of a shop, especially one who is himself a mechanic, can do much to awaken an interest in mechanical matters among those employed by him. If he himself shows some interest in mechanical problems for their own sake, as they present themselves, and in a scientific spirit as well as in a commercial way, if he occasionally refers to something which he has seen in a mechanical paper, and attempts to draw the men into a discussion of the principles involved, he may often be very much surprised at the result, and may awaken a dormant interest in mechanical matters that will be of great benefit to all concerned. We have known the general tone of a shop to be very much improved by the coming into it of a foreman who read mechanical papers, and who took some pains to awaken an interest in them among the men whose work he directed.

Men engaged in professional pursuits, and those who take the leading positions in business affairs, invariably read the best journals pertaining to their line of work or business. Such men know perfectly well that this is a positive necessity for them, and it is becoming more and more a positive necessity for mechanics who have any ambition to be successful.

The *Philadelphia Bulletin* has, we think, a very much exaggerated idea of the value of Mr. Chauncey Depew's services as a railroad president, and in discussing the matter advances some very queer logic. It says: "Could one thousand section hands on the New York Central road manage its affairs as well as President Depew does? If not—and the contrary will hardly be asserted—his services are worth one thousand times as much as any one of them." To perceive the beauty of this logic, we need only to apply it in another direction, and we ask: Could one thousand railroad presidents run a locomotive as well as one good engineer does? If not—and the contrary will hardly be asserted—then the service of one good engineer is worth one thousand times as much as that of any one railroad president. And again, why must we be confined in such matters as these to a paltry thousand or so? It must be evident that one million railroad presidents could not tamp a tie as well as one good trackman can; therefore it must be evident that the service of one trackman is worth one million times as much as that of any one railroad president. And so we might go on and demonstrate, according to this newly discovered system of logic, that the services of any railroad employe whatever are worth a million or more times as much as those of any other employe.

Walter A. Wood.

The well-known manufacturer of harvesting machinery, Walter A. Wood, died at his home in Hoosick Falls, N. Y., January 15, at the age of 76 years.

Mr. Wood's father was a manufacturer of wagons and plows, and, after obtaining some elementary education, Walter was apprenticed in his father's establishment. Afterwards he worked in Hoosick Falls as a machinist, and being of an ingenious and studious turn of mind, his progress was rapid, and he secured several patents on harvesting machinery that proved to be valuable. He was among the first manufacturers of such machinery, and in 1852 made two machines. In 1853 he made and sold three hundred machines, and from that time on his business grew with great rapidity and his machinery became well and favorably known in every civilized country. He paid special attention to the development of foreign trade in harvesting machines, and received many decorations and honors from foreign governments in recognition of his services, among these being the Imperial Cross of the Legion of Honor, by Napoleon III., and the Cross of the Imperial Order of Franz Josef. He served two terms in Congress.

We notice in the advertising pages of the *Engineering and Mining Journal* an advertisement of what is called a "coupon book." The advertiser asks readers, "Do you run a store in connection with your mine, camp or factory?" "Do you know that by using coupons you can *completely control the patronage of your hands* at the store? You can count up your daily sales the same as if you had taken in all cash, which you cannot do if you use punch checks. The great drawback to the check system—that of the checks being transferable—is overcome." The inventor of this device, by which the "patronage" of "your hands" can be "completely controlled," thinks possibly that he has invented something that is of some real use in the world, and he publishes his picture in the advertisement, as though he was proud of his achievement. We cannot find words to express our disgust at the man who can find no better use for what abilities he may possess than to employ them in getting up and selling such a thing as this. And we have no hesitation in saying that any respectable journal ought to be thoroughly ashamed to publish such an advertisement.

Such an advertiser and such a journal are doing what they can to advance the day when there will be trouble resulting from the outrages that are practiced by the assistance of such devices as this.

As our readers of course know, salt water is not good for marine boilers, and a supply of fresh water is usually arranged for in some way. The boats plying the waters about New York usually draw their supplies from some municipal water-works system, establishments along the shore supplying it to them through a meter, which insures that the municipality shall be paid for it. There are boatmen who seem to think that fresh water is as bad for their stomachs as salt water is for their boilers, and thereby hangs a tale. A tugboat was tied one Sunday morning, not long since, to a pier at the works of the Samuel L. Moore & Sons Co., at Elizabethport, getting a supply of fresh water. While the water was running into the tank through a hose, the crew bethought themselves to pass the time away by going to a saloon near by to get a supply of scale resolvent for the supposed benefit of their own internal economies. They did not return as promptly as they supposed they would, and when they did return all they could see of the boat was the top of the pilot-house and the smoke-stack; it had filled up and sunk. It took $12 worth of water to sink the boat, and three days' work by a wrecking company to raise it again.

Some time since we called attention to what seemed to be an epidemic of railroad accidents. We believed then that there was nothing permanent in the matter—that they would follow one another for a short time, as either reason or superstition points out that such things do, and that then there would be a relaxation. It appears that we were wrong in our supposition. No one expects at the present time to read his morning or evening paper without encountering accounts of from one to three accidents with which more or less of horror is connected. It has come to be time when some inquiry should be made into the cause of these accidents. We do not mean the usual coroner's inquest, but a governmental inquiry legalized by an act of Congress if necessary. There ought to be more light on the subject.

There is a proposition to inspect the baggage of those traveling by transatlantic lines while the vessels are at sea. It would be a blessing, so far as it goes, if one could get off a steamship without the nuisance of waiting from one to four hours for some official to nose through his trunks to see if there was not something therein upon which he should pay a fine.

The South Dakota World's Fair Commission has determined to ask Gov. Mellette to call a special session of the Legislature for the purpose of appropriating $80,000, or a part of that sum, for the State's exhibit. In case the Governor refuses to call the Legislature together, the plan which has already been adopted in several counties, viz., appropriations by the Boards of County Commissioners, will be advocated.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(37) C. A. T., Jackson, Mich., writes: A piston is being forced into a cylinder; to do so it takes a pull of four pounds on a lever two feet long from the center of a screw $\frac{5}{8}$ inch diameter, with eleven threads per inch; the screw is well oiled, and passes through a nut one inch long. What effective pressure will be obtained? *A.*—Allowing 70 per cent. for the friction of the screw, the effective pressure will be 1,990 pounds.

(38) E. A. S., Fitchburg, Mass., writes: I have a cone pulley in a lathe; the diameters of its steps are $2\frac{1}{16}$, $2\frac{5}{16}$, $3\frac{1}{16}$ and $4\frac{1}{16}$ inches. I want the largest speed of the driving pulley to be $28\frac{1}{4}$ inches in diameter. What will be the diameters of the other three speeds to run with the cone in the lathe? The distance between the centers of the two pulleys is $30\frac{1}{4}$ inches. *A.*—You can easily find these diameters by following the directions given in answer to Question 120, in our issue of March 12, 1891.

(39) P. V. D., Lansdale, Pa., writes: Please inform me through your columns how to cast a 2-inch soil pipe straight. We are making a lot of them, 5 feet long, $\frac{1}{8}$ inch

thick, and have great trouble with them, as they come out crooked. *A.*—Your trouble is very likely due to having an unequal thickness of pipe. In order to have pipes come out straight it is of great importance that their thickness should be uniform throughout. Then, with careful molding, and by allowing them to cool uniformly, you should not fail to obtain straight pipes.

(40) T. J. W., Binghamton, N.Y., writes: Was your answer to Question 7, in your issue of January 7th, correct? I think you forgot that the load was supported from both sides. *A.*—You are correct, and we thank you for drawing our attention to the error. The line *a b* represents only one-half the weight suspended, consequently we should have said that the stress in *c b* is as much greater than 550 pounds as *c b* is longer than *a b*, and therefore the stress is found by the proportion, 10 feet : 100.49 feet : : 550 pounds : stress in *c b*, which gives us 5,526.9 pounds for the stress in *c b*.

(41) W. M. J., Ottawa, Canada, writes: I am about to balance the cranks of a compound (propeller) engine; the cranks are set at 90 degrees; fore and aft cylinders. How would it do to put on top of each cylinder cover a small cylinder, extending the piston rods through the cylinder covers, and putting on each rod a piston with area sufficient to balance the weight of crank, etc.? Would it make a running balance? Of course the smaller cylinders would have steam below the pistons from steam pipes. I am doubtful about running balance. *A.*—This arrangement has been used for counterbalancing the weight of the piston and rod and connecting rod, but it cannot be used for counterbalancing the weight of the crank. We should advise you not to use it. 2. What is the address of Mr. Benj. F. Wilson, a friend of long ago, and who, I notice, is one of your contributors? *A.*—Bay Port, Florida.

(42) F. C. S., Guilford, Conn., writes: Among the Questions and Answers in a recent issue of your publication, I note that you give a rule for calculating the horse-power of shafting. In your rule the divisor is mentioned as 125, while in a book published by the Mason Regulating Company, entitled "Steam Engineering," a copy of which we presume you have, the divisor is stated as 205 for cast-iron, 110 for wrought-iron, and 80 for steel. Which is right? *A.*—The diameter of the shaft is based upon the torsional strength and stiffness; but, besides this, a factor of safety must be allowed to meet accidental strains, such as winding of belts, sudden resistance by clutch motion, distance between supports, and so on. It is on this account that authorities respecting the size of shafts vary greatly. For ordinary practice, we believe that the sizes obtained by the formulas which we have given will give good results. Under favorable circumstances lighter shafts are admissible. The distinction between iron and steel shafts is disappearing. Soft steel and good iron vary but very little as to strength.

(43) A. O. K., Birmingham, Ala., writes: We have a cast-iron cylinder; it consists of two parts; each is 7 feet 3 inches inside diameter, and 36 inches long. Each part or ring is made in three segments, which are bolted together with four bolts 1½ inch diameter, and the two rings are bolted together with thirty bolts 1½ inch diameter. The metal in the sides of the castings is 2 inches thick, and the flanges are 1½ inches thick, with about ⅝ of an inch fillets in the corners. Our company has made a number of these cylinders, which have to resist an internal pressure of 200 pounds per square inch, and it is found that they will not stand the pressure; they break mostly at the corners of the straight or side flanges. Please answer the following question through your columns: Will a cast-iron cylinder, 7 feet 3 inches inside diameter, 6 feet high, and formed as stated above, stand a pressure of 200 pounds per square inch? Please give your opinion as to the thickness of metal in the sides and flanges, and diameter of bolts. *A.*—We should not allow the tensile stress in the cast iron to exceed 3,500 pounds per square inch; in fact, 3,000 pounds per square inch in such large castings is safer; but, adopting the former figure, then the thickness of the sides of cylinder should be

$$\text{Thickness} = \frac{43.5 \times 200}{3\,500} = 2.48,$$

say 2½ inches. According to Prof. Unwin's Machine Design, the thickness of flanges should be $\frac{9}{10}$ of the thickness of the metal in the sides, plus ⅝ of an inch. This will make the flanges 2⅛ inches thick. The bolts are large enough in diameter, but we believe them to be spaced too far apart, particularly if the cylinders are subjected to steam or water pressure; the distance between the centers of bolts should be equal to about six diameters of the bolts. We believe that, if these figures are adopted, there will be no trouble of breaking the flanges.

(44) Machinist, Hartford, Conn., writes: I have found that the distance across the sides of a square multiplied by 1.4142 will give the distance across the corners. This can be usefully applied in practice, thus: If a screw head is to be turned so it will mill ⅝ of an inch square, I multiply 1.4142 by .375 (which is the decimal of ⅜) and obtain .53, equal to the distance across corners, which is also the diameter of the blank head for turning. As I understand it, the quantity 1.4142 represents the proportion between the base or perpendicular of a right-angled triangle (whose lengths are equal) and the hypothenuse. I suppose a decimal can be found by which the distance across corners of a hexagon head can be computed. Please give me that decimal, and the proof that the multiplier 1.4142 is correct for computing the distance across corners of a square. *A.*—Let *a b c d* be an inscribed square, and *a c* the distance across corners. Here we have a right-angled triangle *a b c*, whose sides *a b* and *c b* are equal; it is required to find the length of the hypothenuse *a c*. The length of the hypothenuse is always equal to the square root of the sum of the squares of the sides *a b* and *a c*; if, now, each of the latter sides is, say, one inch long, then the length of *a c* will be equal to $\sqrt{1^2 + 1^2} = \sqrt{2^2}$. That is to say, the hypothenuse is, in this case, equal to the square root of 2, which is equal to 1.4142. This shows us

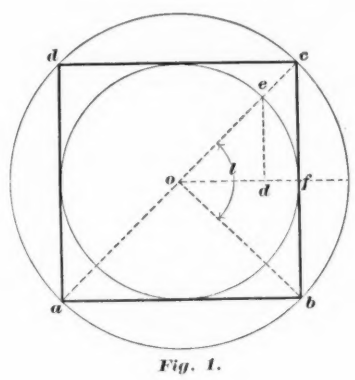


Fig. 1.

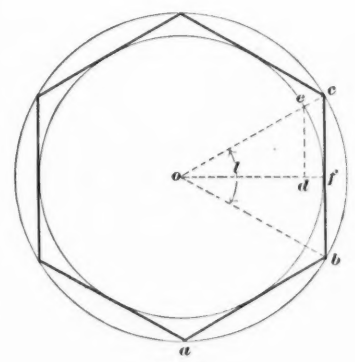
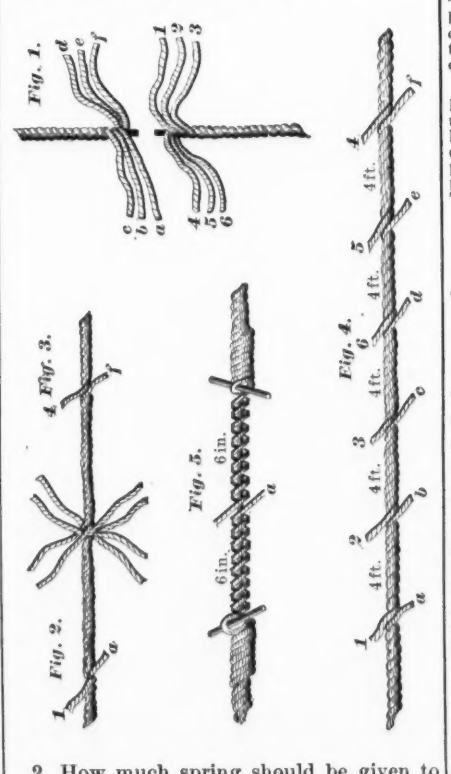


Fig. 2.

that the hypothenuse is 1.4142 times longer than one of the sides, and this proportion holds good, no matter what the lengths of the sides *a b* or *a c* may be, so long as these sides are equal to each other. Problems of this kind may be stated and worked out in another way, thus: The radius of an inscribed circle being given, to find the radius of a circumscribed circle about a regular polygon. The rule for finding the radius of the circumscribed circle is, divide the tangent of half the angle at the center by the sine of the same angle. Using this rule for computing the radius of a circle circumscribed about a square, Fig. 1, we have: The angle *l* at the center is equal to 90 degrees; one-half of this is equal to 45 degrees; the tangent of an angle of 45 degrees is 1.; the sine of this angle is .7071068; and $\frac{1}{.7071068} = 1.4142$, which gives us the same multiplier as found before. Again using the same rule for computing the radius of a circle circumscribed about a hexagon shown in Fig. 2, we have: The angle *l* at the center is, in this case, 60 degrees; one-half of this is 30 degrees; the tangent of an angle of 30 degrees is .57735; its sine is .5; and $\frac{.57735}{.5} = 1.1547$, which is the radius of the circumscribed circle, the radius of the inscribed circle being 1. This result shows us that the radius or diameter of the circle circumscribed about a hexagon is 1.1547 times greater than that of the inscribed circle. Hence if the distance between two opposite sides of a hexagon is known, we multiply this distance by 1.1547; the product will be the diameter of the circumscribed circle. The foregoing rule is based on the following proportion: Sine of ½ angle at the center is to the tangent as 1 is to radius of the circumscribed circle. Or, considering *o f* = 1 in either figure, then *e d* : *c f* : : 1 : *o c*. From this proportion we can find the radius of the circle circumscribed about any regular polygon. The sines and tangents of the angles are taken from tables of natural sines, etc., found in any good engineers' pocket-book.

(45) O. M. B., Fincastle, Va., asks: Can you tell us where we can get a book that treats on splicing wire ropes? *A.*—We do not know of any book that treats on this subject exclusively. The following is taken from a catalogue published by John A. Roebling's Sons Co., manufacturers of iron and steel wire rope:

DIRECTIONS FOR MAKING A LONG SPLICE IN AN ENDLESS RUNNING ROPE, OF HALF-INCH DIAMETER.—Tools required. One pair of nippers, for cutting off ends of strands; a pair of pliers, to pull through and straighten ends of strands; a point, to open strands; a knife, for cutting the core, and two rope nippers, with sticks to untwist the rope; also a wooden mallet. First: Haul the two ends taut, with block and fall, until they overlap each other about 20 feet. Next open the strands of both ends of the rope for a distance of 10 feet each; cut off both hemp cores as closely as possible (see Fig. 1), and then bring the open bunches of strands face to face, so that the opposite strands interlock regularly with each other. Secondly: Unlay any strand, *a*, and follow up with the strand 1 of the other end, laying it tightly into the open groove left upon unwinding *a*, and making the twist of the strand agree exactly with the lay of the open groove, until all but six inches of 1 are laid in, and *a* has become 20 feet long. Next cut off *a* within six inches of the rope (see Fig. 2), leaving two short ends, which must be tied temporarily. Thirdly: Unlay a strand, 4, of the opposite end, and follow up with a strand, *f*, laying it into the open groove, as before, and treating it precisely as in the first case (see Fig. 3). Next pursue the same course with *b* and 2, stopping, however, within four feet of the first set; next with *e* and 5; also, with *c*, 3, and *d*, 6. We now have the strands all laid into each other's places, with the respective ends passing each other at points 4 feet apart, as shown in Fig. 4. Fourthly: These ends must now be secured and disposed of, without increasing the diameter of the rope, in the following manner: Nipper two rope slings around the wire rope, say six inches on each side of the crossing point of two strands. Insert a stick through the loop, and twist them in opposite directions, thus opening the lay of the rope (see Fig. 5). Now cut out the core for six inches on the left, and stick the end of 1 under *a*, into the place occupied by the core. Next cut out the core in the same way on the right, and stick in the end of *a* in place of the core. The ends of the strands must be straightened before they are stuck in. Now loosen the rope nipper and let the wire rope close. Any slight inequality can be taken out by pounding the rope with a wooden mallet. Next shift the rope nippers, and repeat the operation at the other five places. After the rope has run for a day, the locality of the splice can no longer be discovered. There are no ends turned under or sticking out, as in ordinary splices, and the rope is not increased in size, nor appreciably weakened in strength. The foregoing rules apply only to ropes with hemp centers. Ropes with wire centers may be spliced in same manner as hemp ropes by putting in long splice.



2. How much spring should be given to piston rings in common steam engines, with cylinders 6 to 12 inches diameter? *A.*—No rules can be given for determining the amount of set in piston rings; much depends on the kind of rings, individual judgment and experience. We should turn the ordinary cast-iron piston rings about ⅛ of an inch larger in diameter than that of the cylinders of the above sizes.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's new 1892 Gear Book. See page 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Pattern Makers use the Gage Plane.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

$13.00 I Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

S. A. Smith, 23 South Canal Street, Chicago, Ill. agent for Holbrook's Raw Hide Blanks for Gears.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Planer Chucks and 13" Upright Drills. For cuts and price address G. W. Jordan, No. 4 Wayne Street, Worcester, Mass.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Save small iron from foundry refuse. It pays Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

For Sale, Cheap—One second-hand Lincoln Pattern Milling Machine in first-class order. A bargain. W. P. Davis, Rochester, N. Y.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

"Roper's Hand-books for Engineers and Firemen." Descriptive Catalogue mailed free to any address. Edw. Meeks, Pub., 1012 Walnut St., Phila., Pa.

"Hawkins' Calculations for Engineers," 10 Parts, 25c. each, bound $2.50; Catalogue free; Theo. Audel & Co., Pubs., 91 Liberty St., N. Y.

If you want a powerful well-designed Lathe of 16" or 18" swing, beds from 6' to 12' write for circulars. The Parker & Knight Co., Baltimore, Md.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St., N. Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., N. Y.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Literary Notes.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF RECEIPTS, NOTES, AND QUERIES. Edited by Albert A. Hopkins.

This excellent work contains a collection of receipts which were given in the Notes and Queries Columns in the *Scientific American* during a number of years; together with many valuable and important additions. They relate to the manufacture of paper, including papier maché, emery paper, sandpaper, tracing paper, transfer paper, parchments, photograph papers, etc. A large number of receipts for alloys, cements, lacquers, etching, paints, pigments, and varnishes are given. Cosmetics, perfumery and soaps also have received a large share of receipts. The scope for cleansing is very broad, embracing receipts for the removal of spots and stains from all sorts of objects and material, bleaching of fabrics, cleaning furniture, clothing, glass, leather, metals, and the restoration and preservation of all kinds of objects and materials. Nearly every branch of the useful arts is represented, and many formulas used in the various manufacturing industries will be found in this book. It forms a vast compendium of use-

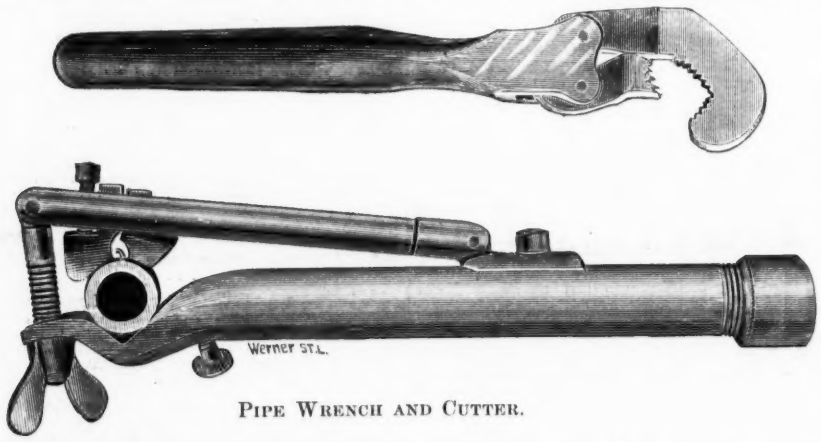
ful information, carefully arranged in alphabetical order, and will prove to be very useful to all artisans engaged in the different industrial branches. It should find a place in every library. The book is published by Munn & Co., *Scientific American* office, 361 Broadway, New York. Price, $5.00.

Aluminium Light.

A very intense light, such as is required for photographic or occasionally for medical purposes, may, as is well known, be readily obtained by burning magnesium ribbon, which has, however, the disadvantage of being somewhat expensive. An excellent substitute has been found by a French chemist, M Villon, in aluminium, which is about a third of the price of magnesium, and which may be utilized in the same manner by burning it in a spirit lamp, or, if a flame of much more intense brilliancy is required, in a coal, gas, or spirit flame supplied with a jet of oxygen.

In these it burns without emitting fumes, in which respect it is superior to magnesium. The light given by aluminium has a high actinic power—nearly as high, indeed, as that of magnesium. The most convenient way of obtaining a very intense light, according to M. Villon, is to use a lamp provided with a jet of oxygen at the center of its flame, into which powdered aluminium mixed with a quarter of its weight of lycopodium and a twentieth of its weight of nitrate of ammonium can be projected by means of a tube furnished with an air ball.

This gives an exceedingly intense light, without smoke. A mixture of aluminium powder with chlorate of potash and sugar can be ignited, giving an intense light by means of gun cotton, but is somewhat dangerous. Probably the best plan for medical photography, or for laryngoscopic and auroscopic and other demonstrations, would be to burn a ribbon of aluminium in an ordinary spirit lamp. Of course, if oxygen and an oxyhydrogen, or an oxyalcoholic lamp were at hand a much more intense light could be obtained —*The Lancet*.



PIPE WRENCH AND CUTTER.

Pipe Wrench and Cutter.

We illustrate by the accompanying engravings some new pipe tools, which have been devised and are being manufactured by Mr. Chas. Miller, Washington, Mo.

The first of these is a pipe wrench which is entirely self-adjusting within its range, and can be operated by one hand. Both the hook and the pawl, as shown in the cut, are pivoted in the end of the hollow handle, and are so connected back of the pivots that they move in unison each with the other. The special points claimed for the wrench are its lightness and simplicity, from which, of course, economy of production results.

The second engraving is of a pipe cutter which seems to meet the requirements of one of our correspondents, who a short time ago mentioned the difficulties arising from the fact that many of the cutters in use raised such a burr inside the pipe that perfect drainage was impossible. This cutter uses a regular cutting tool, which acts the same as a cutting-off tool in the lathe, removing a clean chip from the pipe, and leaving the ends in good shape. The cutter is adjusted by the means plainly shown in the engraving, and the handle is made hollow and used as an oil reservoir, oil being allowed to flow from it when cutting, by turning the small screw at the bottom. This leaves the oil directly in the path of the cutter, insuring its proper lubrication, and at the same time economizing oil. Both these tools have been used sufficiently to demonstrate their practical working.

It is stated, and if it is true it seems to require an explanation, that the managers of the World's Fair do not intend to make any provision for, or allow any to be made for, any exhibit of matters connected with the gas industry, or any gas utilizing appliances. This seems singular, inasmuch as a very liberal provision is to be made for the exhibits of electrical industry, and a special building is to be erected on the fair grounds for this purpose. One of the fair directors is quoted as saying that there are ten persons interested in electricity where one is interested in gas, and that as gas is a back number there will be none of it at the exposition. He is entirely mistaken in his statement. There are ten times as many people in this country who use gas for lighting and other purposes as use electric lights, and the gas industry has quite as much importance and as good a right to a show at the fair as electricity. There are more than $400,000,000 invested in the gas manufacturing and gas supplying business in the United States, and it is an industry that should be recognized. —*The Evening Journal* (Jersey City).

Newark has got her new supply of pure drinking water, and rejoices greatly, and with good reason, thereat. Jersey City might have had the same desirable water supply now, and at a cost considerably less than that which Newark pays, if common sense and business-like methods of discussing and dealing with the question of a new water supply had not here been driven into the background and out of sight by foolish dissensions and cranky gabble. The growth and prosperity of Newark will be at once and notably promoted by the possession of a supply of pure water. It is exasperating to think that we might just as well have had a similar benefit.—*Jersey City Journal*.

In *Electrical Plant* (London) for January, is a description of a planer made by W. Asquith, of Halifax, which is for planing 12 feet wide, 5 feet high. There are two platens side by side, each sliding upon flat ways and driven by a screw. The arrangement is such that with both screws in motion the two platens move together as one, but where smaller work is to be done they may move independently, or either of them may remain still while the other is in motion. The machine was built for an electrical engineering establishment.

At present the total mileage of railways in Japan is 1,137.66 miles. The government owns and operates 551.27 miles. The remainder, 586.39 miles, are private lines. Besides these, there are 1,270 21 miles in course of survey and construction.

The Brazilian government has rescinded the law requiring foreign merchants shipping goods to Brazil to present invoices and bills of lading to Brazilian consulates for legalization.

MANUFACTURES.

It is possible that an electric light plant will be established at Chico, Cal.

It is probable that an electric light plant will be erected at Dryden, N. Y.

C. H. Hartshorne is building a one-story machine shop at Worcester, Mass.

An incandescent electric lighting plant will be established at Galt, Ontario.

C. S. Atkinson has begun the erection of a new foundry at New Hope, Pa.

The recently burned Grove Fertilizer Works at Perdix, Pa., will be rebuilt.

The Standard Iron Company is improving its plant at Martin's Ferry, Ohio.

The Baker Wire Nail Company will erect a brick iron-works at Cleveland, Ohio.

Cairo, Ill., offers $50,000 bonus and a free site for the location of car works there.

A. H. Miller will erect a laundry and boiler house at Chicago, Ill., 4107 State street.

The Somerworth Machine Company, of Great Falls, N. H., is being reorganized.

Frank H. Elson has broken ground at New Haven, Conn., for a boiler factory.

George M. Battey's recentiy burned machinery plant at Rome, Ga., is being rebuilt.

The Reed Foundry at Warren, Ohio, has been leased by Messrs. Morrison & Gartner.

The recently burned Lock Machine Works at Bradford, Pa., will be rebuilt at once.

The American Construction Company will erect an electric light plant at Monroe, N. C.

The New Process Nail Company has begun the erection of a plant at Torrington, Conn.

The Maryland Electric Light and Power Company has been incorporated at Baltimore, Md.

Work will begin on the new steel rolling-mills at Denver about the middle of the month.

McDonald & Sons have started their iron foundry and machine shop at Wytheville, Va.

It is stated that the Amboy shops of the Illinois Central are to be removed to Freeport, Ill.

An electric light plant is reported as to be put in the State Insane Asylum at Raleigh, N. C.

Alfred Tutts & Co. are reported as erecting an addition to their iron works at Algiers, La.

J. Rigby states that he expects to put in an electric plant and an ice plant at Cambria, Va.

A 90x90-foot addition will be built to Davies & Thomas' foundry, at East Catasauqua, Pa.

The Chicopee (Mass.) Manufacturing Company will erect a new engine house at its plant.

The Central Iron Works Company is to erect a $20,000 addition to its plant, at Steelton, Pa.

The engine house at Kendall, Hadley & Co.'s plant, at Goffstown, N. H., is to be enlarged.

There is talk of increasing the capacity of the Gilbert Car Works at Green Island, Troy, N. Y.

Mr. Echols, of Huntsville, is arranging for the establishment of an ice factory in Eufaula, Ala.

The Griffin Wheel and Foundry Company, of Chicago, has increased its capital stock to $350,000.

The West Point (Ga.) Cotton-mills have added a machine shop and a cloth-finishing department.

Stewart Bros. will put new machinery in their knitting and woolen-mill, at Guyandotte, W. Va.

A wire-drawing plant is to be added to the works of the Insulated Wire Company at Sycamore, Ill.

The Kennon Manufacturing Co., of Brunswick, Ga., will make a large addition to its cotton-mill.

The Lisk Manufacturing Company has decided on the site for its new plant at Canandaigua, N. Y.

McCormick & Co. will continue to make additions to their iron plant at South Harrisburg, Pa.

New machinery will be placed in the Oakland (Md.) Electric Light and Power Company's plant.

The Holcomb-Brown Iron Company, Burlington, Ia., capitalized at $350,000, has been incorporated.

Some capitalists are forming a company at New Bedford, Mass., for the manufacture of artificial ice.

The Bloch Bros. Tobacco Co., Wheeling, W. Va., will put an electric light plant in its tobacco factory.

New machinery is being put in the plant of the S. C. Forsaith Machine Co., of Manchester, N. H.

A two-story pattern shop is being erected by the Whitcomb Manufacturing Company, at Worcester, Mass.

The St. Paul (Minn.) Electric Manufacturing and Power Company will erect a $5,000 plant at St. Paul.

The Oakland (Md.) Electric Light and Power Company will put new machinery in its electric light plant.

The Bluffton Car Wheel Company, Bluffton, Ark., will soon commence operations at its car wheel works.

The Western & Atlantic Railroad Company will put new machinery in its machine shops at Atlanta, Ga.

The National Hancock Rotary Plow Co. has been incorporated in Virginia. Capital stock, $100,000

A stone crusher with engine house will be put up, under the management of Daniel King, at Florence, Ala.

Almons & Jackson, Moon, Ga., have erected a factory building, for the purpose of manufacturing fertilizers.

The Bristol Iron Works, of Bristol, Tenn., have been organized, for the manufacture of wrenches, plows, etc.

It is understood that J. W. Pike will erect a factory at Amsterdam, N. Y., to manufacture knitting machinery.

Rhodes Brothers contemplate the erection of a plant for the manufacture of merchant iron at Denver, Col.

New machinery is to be placed in the Upper Appomattox Electric Light Company's plant at Petersburg, W. Va.

The Wright Machine Company, at Worcester, Mass., are building an additional machine shop 100 x42 feet in size.

The Holcomb Brown Iron Company has been incorporated at Burlington, Iowa, with a capital stock of $350,000.

R. E. Kidder, pattern maker and manufacturer of patent saw tables, etc., Worcester, Mass., will increase his plant.

Efforts are being made for the organization of a $30,000 stock company to establish a knitting-mill at Edenton, N. C.

The Beargrass Woolen-mill, Louisville, Ky., will put in machinery for the manufacture of worsted yarns early in 1892.

It is possible that the Northwestern Slate Company, of Milwaukee, may locate a branch factory at Waukesha, Wis.

We understand that the Canton (Ohio) Pump Company will locate its foundry department in Akron, same State.

Efforts are being made by William Bailey, of Southington, Ct., to establish an edge tool factory at Plainville, same State.

The Little Bros. Fertilizer and Phosphate Company, South Jacksonville, Fla., will put in pyrites furnaces at its fertilizer works.

The Baltimore & Ohio Railroad Company (office, Baltimore,) will rebuild its electric light plant at Brunswick, Md, recently burned.

The Upper Appomattox Electric Light Company, Petersburg, W. Va, will, it is reported, put new machinery in its electric light plant.

The People's Electric Light and Gas Company has, it is reported, put new machinery in its electric light plant, Birmingham, Ala.

The Buffalo Cast-iron Pipe Company will establish an extensive plant at Buffalo, N. Y. G. B. Hayes is president of the company.

W. J. Stewart will erect a 25,000 gallon water tank for fire protection at Carrollton, Ga., and wants a pump for lifting water.

It is reported as possible that the Des Moines (Ia.) Cotton-mill Company, whose mill was destroyed recently, will rebuild at Hammond, Ind.

It is understood that the Superior Manufacturing Company, of Kankakee, Ill., has been incorporated, to manufacture nails. Capital, $100,000.

The Phelps Manufacturing Company has been incorporated at San Francisco, Cal., with a capital of $300,000, to manufacture iron, steel, etc

The Chase & Son Company has been organized at Portland, Me., for the purpose of manufacturing machines, tools and supplies of all kinds.

The Barnett Manufacturing Company, of New York, has been organized, for manufacturing packing for steam engines, etc. Capital, $5,000.

At Temple, Tex., the Rockland Plow Company has been incorporated by G. E. Wilcox, J. E. Moore, A. M. Kellar and others; capital stock, $100,000.

The Louisville & Nashville Railroad Co. (office Louisville) is reported as to remove a part of its Louisville shops to Latonia, near Covington, Ky.

The cotton tie and rolling-mill of the Denison Rolling-mill Company, at Denison, Texas, is nearing completion, and will soon be put in operation.

The Nail City Stamping Company, with a capital limited to $1,000,000, has been incorporated at Charleston, W. Va., by J. N. Vance, A. W. Paul and others.

The Florida Iron and Wood-works Company, at Apopka, Fla., will put new machinery in and increase the capacity of its works and wood working factory.

The Dixon Power and Lighting Company has been formed at Dixon, Ill.; capital, $75,000. Incorporators—F. A. Watson, A C. Bardwell and F. A. Truman.

The San Antonio (Texas) Cold Storage and Manufacturing Company, lately incorporated, will put in a 20 or 25-ton refrigerating plant and a small machine shop.

It is said that the Eames Vacuum Brake Company has secured control of a large tract of ground near Watertown, N. Y., upon which it will erect a manufactory.

Excelsior Foundry Company has been incorporated at Belleville, Ill.; capital, $10,000. Incorporators—George M. B. Rogers, Ed P. Rogers and John E. Thomas.

The Crane Company, Chicago, Ill., have taken the western agency for the injectors manufactured by the Hayden & Derby Mfg. Company, 111 Liberty street, New York.

The Birmingham Water-works Co., of Birmingham, Ala., has made a survey for an extension of its water mains to supply the towns of Avondale and Woodstown, Ala.

The Savannah, Americus & Montgomery Railroad Co. (office, Americus, Ga.,) is reported as to erect machine shops and roundhouse at Clisby's Park, Montgomery, Ala.

The Clarence H. Rose Company will probably be incorporated with a capital stock of $200,000 to operate the plumbers' supply works, etc., of Clarence H. Rose, at Shendun, Va.

The Board of Trade at Wilmington, Del., has decided in favor of the county building a new bridge across the Brandywine, at some site between Van Buren and Clayton streets.

The rebuilding on a larger scale of the works of the Carpenter Steel Works, Reading, Pa., recently burned, was commenced at once, in order to fill government contracts for steel projectiles for heavy ordnance.

Curtis & Curtis, of Bridgeport, Conn., manufacturers of the Forbes patent die stock, pipe-cutting and threading machinery, etc., have just shipped to the Pacific coast, on one order, fourteen of their pipe-cutting and threading machines.

W. H. Nicholson & Co., Wilkes-Barre, Pa., send us a catalogue of the specialties manufactured at the works, such as expanding lathe mandrels and compression shaft couplings. The catalogue contains a large number of testimonials from those using the devices.

The Parker & Knight Co., of Baltimore, Md., have recently incorporated, with a capital of $25,000, for the purpose of building lathes and special machinery. They are thoroughly equipped and are in full operation, having already placed several lathes on the market.

The Southwestern Bridge Company has been incorporated at Little Rock, Ark., with W. B Woody, of Rockdale, president; J. O. Hill, of Navasota, vice-president, and T. M. Freeman, secretary, for the construction of self-supporting bridges. The capital stock is $100,000.

The Ohio Falls Power Company has been incorporated at Louisville, Ky., with J. Proctor Knott as president; A. S. Willis, vice-president, and George Du Relle, secretary, to produce, distribute and sell power for mechanical purposes. The authorized capital stock is $1,000,000.

Perkins & Co., Grand Rapids, Mich., write us: Our trimmer business during the past year has been exceptionally good, far beyond our expectations, and this year promises to be better than last. Our shingle machinery business is also booming, and we anticipate a large trade next year.

E. D. Whipple, who now does general machine repairs, general job work, and builds special machinery at North Bennington, Vt., has associated with himself Mr. M. P. Armstrong, of Bristol, Conn., and the firm, to be known as the Whipple & Armstrong Machine Company, will remove about the first of February to Harriman, Penn.

E. D. Goodwin, manager of the Chicago house of Lodge, Davis & Company, sends us a neat morocco-bound card-case, pocket-book and removable memorandum book. It is as neat as anything we have ever seen in the line; it is literally a memorandum book, with only two pages devoted to advertising the business of the company.

The extensive iron plant of Brown, Bonnell & Co., of Youngstown, O., has been purchased by trustees representing the creditors, for $700,000, and as about nine-tenths of the creditors of the old concern have consented to take such stock in the new company, the capital of which will be $1,000,000, the works will continue in operation.

The Southern Emery Wheel Co., recently incorporated at Tallapoosa, Ga., to manufacture emery wheels, etc., has increased its capital stock from $25,000 to $50,000. The company has elected its officers as follows: Charles Heaton, president; W. D. Howe, vice-president, and W. H. Lemmon, secretary. Work on the plant is now in progress.

The Ironton Structural Steel Company, capitalized at $1,000,000, has been organized at Duluth, Minn., to smelt and work iron ores and manufacture iron and steel. The main office will be in New York, and a plant will be erected near Ironton. The incorporators are Rudolph T. McCabe and Wm. R. Meath, of New York, and Robert C. Belville, of Trenton, N. J.

The United States Graphite Company, of East Saginaw, Mich., now has its new works completed and in full operation. The company manufactures a line of graphite products and has control of the Plombogina graphite mine in Sonora, Mex. It is now marketing plumbago lubricants of all kinds, foundry facing, floated graphite and graphite paint and plumbago cement.

One of the interesting features of the trial trip of the U. S. ironclad "Miantonomah" were the hydraulic pressure pumps for working the guns. These were of the Blake design, built by the Geo. F. Blake Mfg. Co., and work successfully against a water pressure of 1,000 pounds per square inch. The guns at the shop in the Washington Navy Yard are worked by Blake hydraulic pressure pumps; also the guns at the testing grounds of the U. S. Ordnance Department.

Mr. Geo. Richards, for many years the managing director of Messrs. Geo. Richards & Co., Limited, Engineers, of Broadheath, near Manchester, retired from that position last June, and has established a new company, The Richards Machine Tool Co., with London offices at Suffolk House, Laurence Pountney Hill, E. C. Mr. Richards is also interested in The Richards Patent Pulley Co., London, which has been formed to manufacture his latest patents on wrought-iron pulleys and shaft brackets on an extensive scale.

The Greensburg Rolling-mill Company, of Greensburg, Pa., has been granted a charter of incorporation, with a capital stock of $100,000. This new concern is composed principally of capitalists of Greensburg, and they propose to operate a rolling-mill on the site formerly occupied by the Greensburg Steel Company. The latter concern built a small plant for the manufacture of crucible tool steel, which was operated for only a few months. Some of the parties identified with the Greensburg Rolling-mill were stockholders in the Greensburg Steel Company.

The Berlin Iron Bridge Co., East Berlin, Conn., is just completing a new machine shop for the Bridgeport Machine Tool Co. at Bridgeport, Conn. The building is made entirely of brick and iron, divided into two parts, each 40 feet wide—the total length being 96 feet. One portion is two stories high, the roof and floor being designed for light work, while the opposite half of the building is of the same height, but the second floor is omitted, so that it may be used as an erecting shop. The erecting shop is covered by a traveling crane. The building, when completed, will, it is believed, be one of the most perfect and best designed machine shops in the New England States.

Volney W. Mason & Co. (Friction Pulleys, Friction Clutches for Connecting Shafting, Hoisting Machinery and Elevators), Providence, R. I., write us: In relation to business the past year we have no very large contracts to report, but a steady succession of orders has kept us busy, and we have been able to fill orders with greater promptness than usual; also to put in stock more than usual ready for prompt delivery. Our new patent whip hoists are being introduced for a greater variety of purposes than we even imagined, owing to their simplicity of working and the notable feature of holding their load without constant hand pressure on the brake, a single lever operating to hoist, lower, and holding the load. The acme of simplicity seems to have been attained in this hoist, being especially well adapted for being operated by electric motors as well as steam or gas engines. We are also endeavoring to attract foreign trade, of which we had some before our last tariff went into effect, but legislation looking toward free trade would doubtless favor our business with other shores.

Holford Engineering Works, Birmingham, England, write us: In the early part of last year we acquired the works and business formerly belonging to the English Gatling Gun Company, Limited, which company went into liquidation. The works had been equipped with a very large and efficient plant of American machines of the best types, and seeing the steady and growing demand in England for this type of machinery, we decided to take up the manufacture of similar machines in addition to the manufacture of machine guns and ammunition. Mr. George Accles, who is the resident managing director, has had very extensive experience in America in some of the best shops, and he has been joined by his brotner, Mr. William S. Accles, who has also had a wide experience in America, and now fills the post of works manager. We have already produced several lines of improved milling machines drills, turret lathes, etc., which embody the leading features of the best American machine tools of a similar nature. The machines already delivered have met with high approval, and there is no doubt that we have a very successful future in front of us in this branch of our business. We have recently taken up the manufacture of the Richards patent envelope making machine, which was first brought out by the Pratt & Whitney Co., of Hartford. We are also arranging to manufacture the new six-spindle drill patented by A. D Quint, of Hartford. To Americans who desire the usual high-class American workmanship on machines built in England, with a view to placing them on the English market, our works afford exceptional advantages. The Gatling gun, for which we possess the exclusive right of manufacture for the eastern hemisphere, has been very greatly improved by Mr. George Accles during the last few years, and he has now completed a further important improvement by which the feed drums hitherto used may be dispensed with and the cartridges fed directly into the gun. This improvement very greatly increases the efficiency of the gun and reduces the weight for transport, and the gun is now more than ever superior to its rivals. Our works are busily occupied upon several government contracts for ammunition and other stores, and at the present time there are about four hundred hands employed.

Machinists' Supplies and Iron.

NEW YORK, January 23, 1892.

Iron—American Pig—The market remains very quiet and without indication of improvement.

We quote Standard Northern brands, No. 1 Foundry, at $16 to $17; No. 2, $15 to $16.50; Grey Forge, $13.75 to $14 50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.50 to $16 for No. 2; $14 25 to $14.50 for No. 3.

Scotch Pig—Coltness is quoted at $22; Eglington $20.25.

Antimony—There is an improved demand, and stocks are being reduced.

We quote Cookson's, 15¾c. to 16c.; Hallett's, 11¾c.; L. X., 14c.

Copper—There has been no change in the price of Lake, and it is held at 11 cents from first hands. Casting Copper is firm at 10¼c. to 10⅝c.

Lead—Considerable business has been done at 4 10 cents, but 4.15c. is the regular quotation.

Lard Oil—Prime City is quoted at 54c. to 55c.; Western at 53c. to 55c.

Spelter—The market is still easy, and prices are nominal at 4⅜c. to 4.65 cents.

Tin—The market is weaker, and there have been sales on spot at 19.60 cents in 15 ton lots.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Constructing eng'r desires steam plant work or supt's position; salary, $200 m'thly. M. E., AM. MACH.

Situation as sup't or foreman pattern maker, by an A1 practical mechanic. Pattern, AM. MACHINIST.

Two machinists used to all-around work desire situations. Address F. M., AMERICAN MACHINIST.

Graduate of technical school, with some experience as draftsman, desires position; South preferred. Address BOX 33, AMERICAN MACHINIST.

Wanted—First class tool dresser; steady employment at $3.00 per day; give age and reference. "Milwaukee," care AMERICAN MACHINIST.

Wanted—Wood pattern maker; one accustomed to patterns for brass goods for water, gas and steam; give exp. and ref. Box 36, AMER MACHINIST.

Wanted—1st-class machinist, one thor'ly acquainted with the Niles upright boring and turning mill. James Hunter Machine Co., North Adams, Mass.

First-class mechanical draftsman with practical experience as well as theoretical training desires pos. in N. Y. City or Bklyn. Box 39, AM. MACH.

Wanted—Position as assistant in drawing-room; have had considerable experience. A1 references. Address Box 38, AMERICAN MACHINIST.

Mechanical draftsman, 25, college graduate, with 4 years' practical exp. in engine and boiler work, wants to make a change. Box 41, AM. MACHINIST.

Wanted—One first class flange turner and one boiler maker. Address, with references, Charleston, care of AMERICAN MACHINIST

Wanted, Position—Experienced in the manufacture of duplicate work and appliances, mach and tool desig'g (and making) and gen. shop eng.; 14 years exp. A1 refs. Box 40, AMER. MACHINIST.

Wanted—Position as foreman in marine or stationary shop, by an experienced man; can work men to advantage and furnish first-class references. Address H. M. C., 957 20th, Erie Pa.

Superintendent well up in drop forging, tempering and case hardening fence and ornamental iron-work wishes an engagement with a reliable firm. T. H., AMERICAN MACHINIST.

Wanted—A position as foundry foreman; having 20 years' experience on all kinds of light and heavy work, can furnish first-class recommend. Address Box 29, AM. MACHINIST

Wanted—A first-class workman that is experienced in taking charge of a shop on nice light machine work. None but a first-class man need apply. Address A. K. Z., 3032 5th Avenue, South Minneapolis, Minn.

A mechanical engineer desires situation; especially skillful in the design of new machinery, or the remodeling of old; experienced in making machines and tools for special purposes Salary, $200 monthly. Box 37, AMERICAN MACHINIST.

Tool maker 32, steady, twelve years on tool work, used making of cutters, etc.; repairs to iron and wood working machinery; understand rear and rack cutting, setting up of machinery, shafting, etc. N. Y. or vicinity pref. N. Y. C., AM. MACH.

Wanted—A man to take charge of tool-room, which is thoroughly equipped with modern first-class tools, and working about 15 men; must be well posted in manufacture of milling cutters, jigs, templates and special tools; location, western Pennsylvania. Address Box 34, AMERICAN MACHINIST.

Party with large successful selling and contracting experience, embracing whole country, used to large transactions, for years, until recently, with concern of national reputation on salary, but now in business own account, with office modern building Cortlandt street, can give about half time to representing A1 concern on commission entirely. Business showing highest immediate returns given pref. Cortlandt St., care AMERICAN MACHINIST.

✝ MISCELLANEOUS WANTS ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

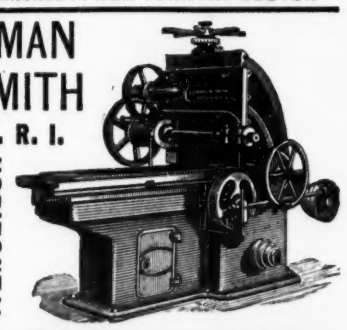
Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

*Bradley Hammers

REPUTATION.
Men test everything in this world by what it produces.
2000 IN USE
BRADLEY & COMPANY, SYRACUSE, N. Y.
BRANCHES IN NEW YORK AND BOSTON

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

BEAMAN & SMITH
PROV. R. I.
HORIZONTAL SPINDLE MILLING MACHINE.

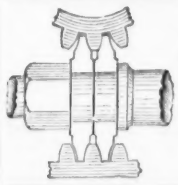


WIRE:
Its Manufacture and Uses.
By J. BUCKNALL SMITH, C. E.
400 pages, 150 illustrations. 8vo., cloth, . $3.00
JOHN WILEY & SONS, New York.

SOFT GRAY IRON CASTINGS
From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build
ONTARIO IRON WORKS
CANANDAIGUA, N. Y.

POPULAR AND INSTRUCTIVE BOOKS
FOR ENGINEERS AND FIREMEN,
By STEPHEN ROPER, Engineer.
Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them.
Descriptive Catalogue Mailed Free.
EDWARD MEEKS, Publisher,
No. 1012 Walnut St., PHILADELPHIA, PA.

American Standard Gauge & Tool Works
WILMINGTON, DEL.
Makers of Implements for Standard Measurements
Over 48,000 in Use.
Crescent Gauge.
Flat Bar Gauge.
JAS. A. TAYLOR & CO.



CLOUGH'S DUPLEX CUTTERS.
Reduction in prices to clear out my stock on hand. Now is the time to buy, as they will soon be gone. All sizes from 3 to 48 Pitch. Address
R. M. CLOUGH,
TOLLAND, CONN.

FOR SALE
An old-established device for removing flues from boilers. Is being used in leading shops. A fortune in it. Can be purchased reasonably. Address
VANCE TUBE CUTTER CO.,
GENEVA, N. Y.

Machine Tool Business For Sale.
The advertiser, desiring to give his personal attention to other business, wishes to dispose of his Machine Tool Manufacturing Business, which is well established and located in an important center for that business. Stock, Machinery and Business are worth $30,000, with contracts and agencies insuring a prosperous business Address, MACHINE TOOLS, care of AMERICAN MACHINIST.

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

Wanted—Small second-hand Ice Machine. Parker & Waters, Warren, Ark.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Set of second-hand Rolls; length, 14 feet or more. The Atlantic Works, East Boston, Mass.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

Cheap—Two H. P. Engine Blue Prints complete. Designed to be built on an ordinary lathe. W. A. Smith & Co., 24 Custom House St., Providence, R. I.

For Sale—Recently patented expansion mandrel, with universal and independent blades; will be sold at a reasonable figure. For particulars, address A. J. Ingraham, 812 Arch St., Philadelphia, Pa.

Wheel Press Wanted—Wish to correspond with parties having a good second-hand machine for sale. State capacity and other particulars. Rand Drill Co., N. Tarrytown, N. Y.

Wanted, Agency—By an exp'd mech. eng., having large acquaintance with rolling-mills, railroads, machine shops, etc. Address Fred. Hoeppner, 95 Westinghouse Building, Pittsburgh, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa

UNIVERSAL GRINDING MACHINES.

Hear what they say that use them:

THE CANADIAN RAND DRILL CO.,

SHERBROOKE, P. Q., CANADA, Feb. 17, 1891.

LANDIS BROS., Waynesboro, Pa.

GENTLEMEN:—The Grinding Machine purchased of you is giving entire satisfaction. We regard it as a superior tool in both design and execution.

Yours truly, CANADIAN RAND DRILL CO.,
Per F. A. HALSEY.

LODGE & DAVIS MACHINE TOOL CO.

CINCINNATI, OHIO, Sept. 6, 1891.

LANDIS BROS., Waynesboro, Pa.

GENTLEMEN:—We are pleased to inform you that the Grinding Machine reached us safely, and has now been running steadily for the last ten days, and is doing as elegant work as we ever produced, and we have two of what are considered the finest Universal Grinders in the market.

Your improved features for quick changing of feed, and the nice arrangement for changing from external to internal grinding, and in fact the whole arrangement, gives entire satisfaction, and we hope to place other orders with you from time to time as we increase our capacity.

Yours truly,
THE LODGE & DAVIS MACHINE TOOL CO.

BELLOWS Beam Micrometer

Send for CATALOGUE to

STANDARD TOOL CO., Athol, Mass.

BRISTOL'S Patent STEEL BELT LACING.

SAVES TIME, SAVES BELTS, SAVES MONEY, SAVES PATIENCE.

THE BRISTOLS' MFG. CO., Waterbury, Conn.

MACHINERY For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information, address the Manufacturer,

S. W. GOODYEAR, Waterbury, Ct.

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

HUGO BILGRAM,
MACHINIST,
Successor to
BREHMER BROS.,
440 N. 12th St., Philadelphia, Pa.

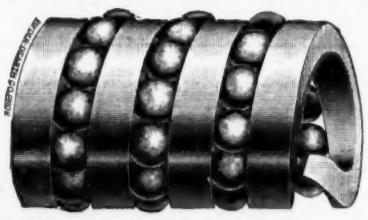
MILLING MACHINES and PATENT CUTTERS.

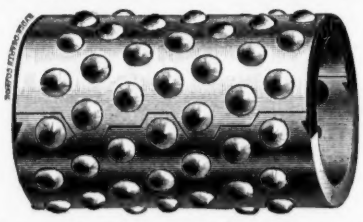
Do not buy without getting our prices, photos and references. We make machines to mill up to 22 in. wide by 10 ft. long, very heavy and powerful. Correspondence solicited.

THE INGERSOLL MILLING MACHINE CO.,
ROCKFORD, ILL.

THE HOWARD MULTIPLE BALL BEARING.

No. 1





No. 2

Applicable to Frictional Bearings in General. Now running at our works and showing a saving of about two-thirds in power.

MOSSBERG MANUFACTURING CO., Attleboro, Mass.

DRAWINGS, FINE MACHINERY AND TOOLS TO ORDER.

DRILL PRESSES FOR LIGHT WORK.

Send for Particulars.

MILLIKEN & D'AMOUR,
151 and 153 Cedar Street, NEW YORK CITY

BRASS AND BRONZE CASTINGS A SPECIALTY.

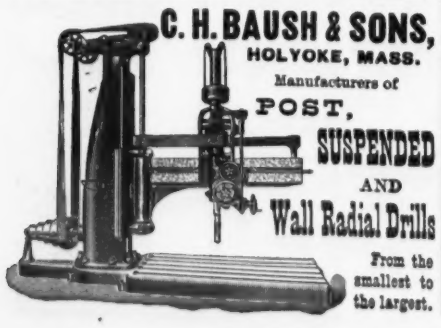
By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.

GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y

Manufacturers of

Drawing Materials, Surveying Instruments, &c.

Paragon Drawing Instruments, Extra and Best Quality, German Drawing Instruments, Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile and Cross-section Papers. Catalogue to professional people on application.



C. H. BAUSH & SONS,
HOLYOKE, MASS.

Manufacturers of

POST, SUSPENDED AND Wall Radial Drills

From the smallest to the largest.

New and Second-hand Machinery

AND MACHINISTS' SUPPLIES.

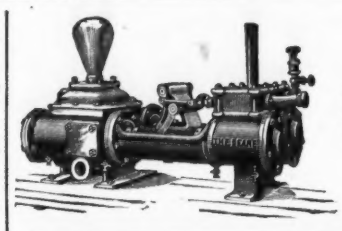
	Listed at
2 Backgeared Screw Cutting Reed Lathes, 8 ft. 4 in. long, 18 in. swing	$250 00
3 Backgeared Screw Cutting Reed Lathes, 6 ft. 2 in. long, 16 in. swing	200 00
11 Backgeared Screw Cutting Reed Lathes, 6 ft. 4 in. long, 14 in. swing	180 00
Above Lathes, latest improved cross-feed.	
1 Universal Milling Machine, Brown & Sharpe, with complete attachments, cutters and spindles	400 00
1 Wood Turning Lathe with slide rest, 26 in. swing, 10 ft. bed	190 00
1 Pratt & Whitney Monitor Screw Machine	250 00
1 Lathe, 6 ft. long 12 in. swing, Prentice	185 00
1 No. 2—4 Spindle Drill Press Garvin	140 00
1 No. 4—4 " " " "	230 00
1 Speed Lathe, 4 ft. long, 13 in. swing	75 00
1 Lathe, " " "	75 00
1 Lathe, 3 ft. 6 in. long, 10 in. swing, Reed	65 00
1 Shaping Machine, 16 in., Prentice	250 00
1 Small Monitor Lathe, 3 ft. 6 in. long	160 00
1 Power Punch Press, No. 94, E. W. Bliss	200 00
1 Shaping Machine, 24 in. stroke, Hendey	350 00
1 Small Universal Grinding Machine	130 00
1 3-Spindle Drill Press, Sigourney & Co.	130 0
1 Power Press No. 2, Styles & Parker	150 00
1 Small Lathe, 4 ft. long, 9 in. swing, Young & Co., Geared for Screw Cutting	90 00
1 Small Emery Grinder	20 00
1 No. 1 Diamond Emery Wheel	18 00
1 No. 3 Emery Grinder	90 00
1 Poppin Grindstone, No. 0	6 00
1 Sturtevant Forge	20 00
3 Single Spindle Drill Presses, Reed	125 00

SECOND-HAND BELTING GOOD AS NEW.

Also an assortment of Iron Split Pulleys, Lathe and Drill Chucks of all sizes, and other small tools, such as Drills, Reamers, etc.

The above being a complete assortment of machinists' tools bought and intended to be used by the Niagara Metre Co., now dissolved.

E. S. LEAYCRAFT & SON,
44 Dey St., New York.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

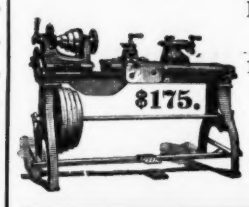
MAKERS OF

CRESCENT STEEL CO.

PITTSBURGH.
CHICAGO.
NEW YORK.

The FINEST STEEL

NOW USED FOR **TOOLS, DIES, MILLING CUTTERS, &C.**



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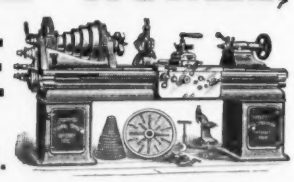

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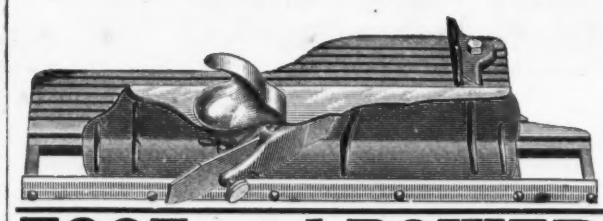

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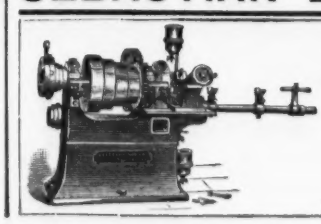

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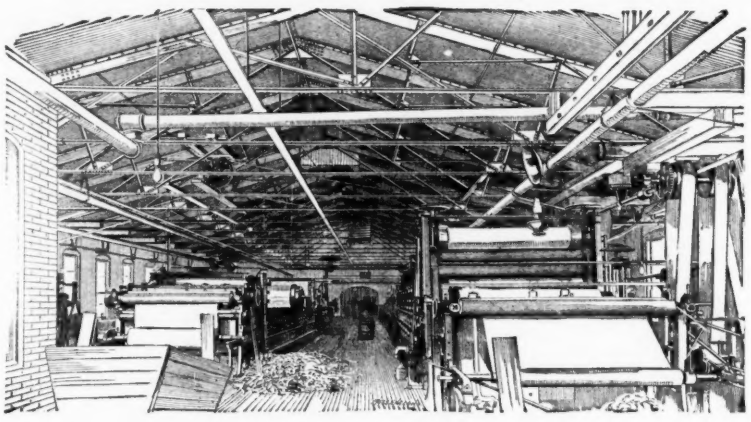

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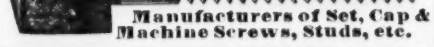

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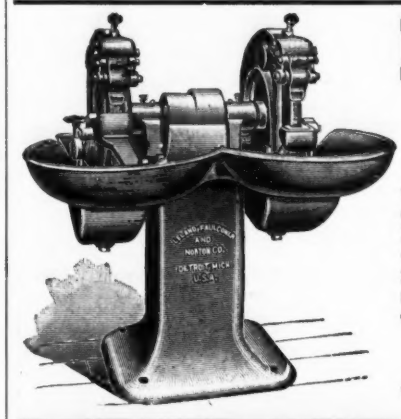

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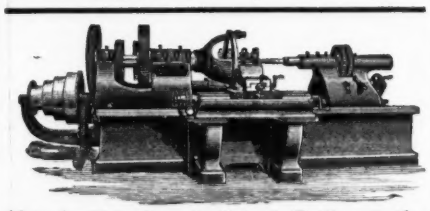

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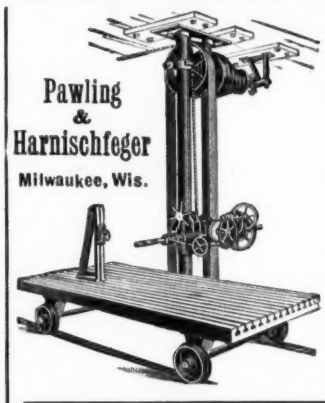

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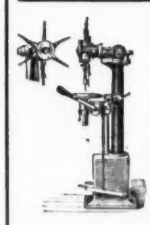

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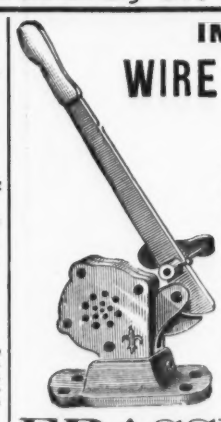

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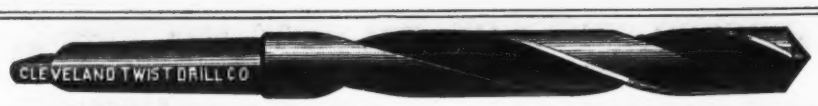

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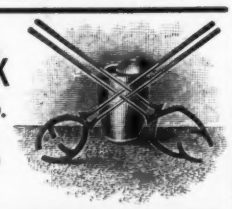

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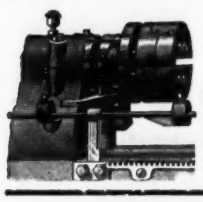

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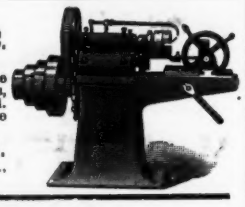

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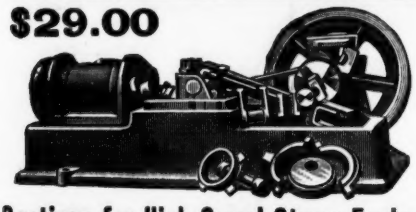

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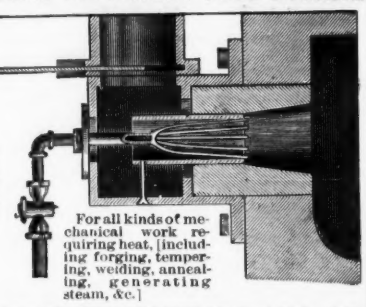

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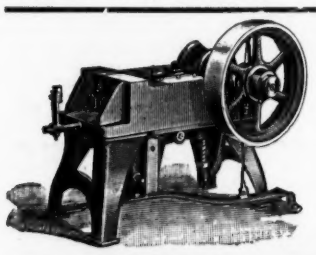

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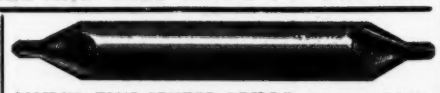

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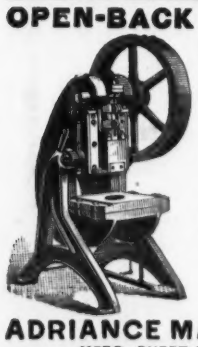

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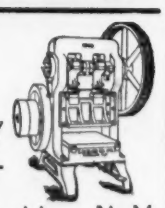

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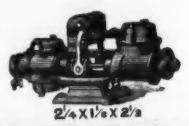

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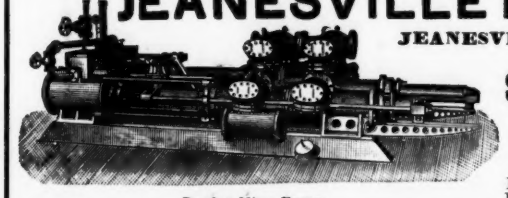

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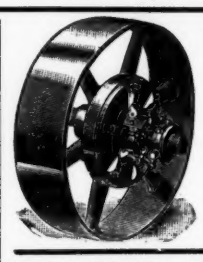

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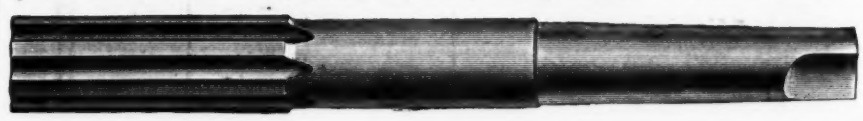

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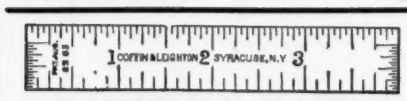

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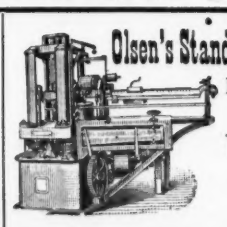

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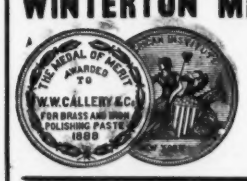

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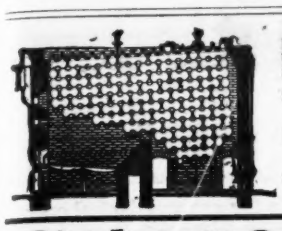

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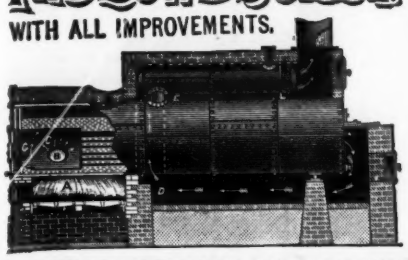

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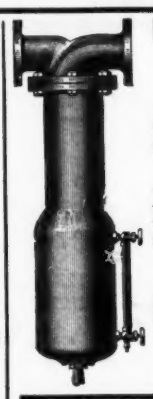

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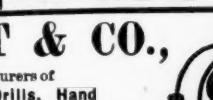

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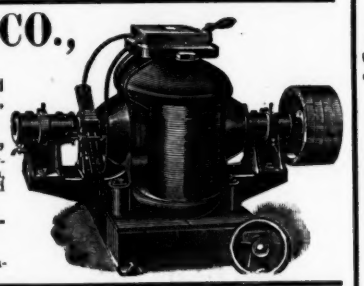

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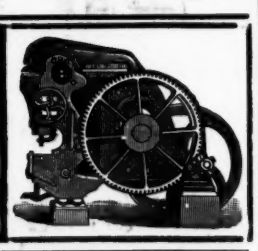

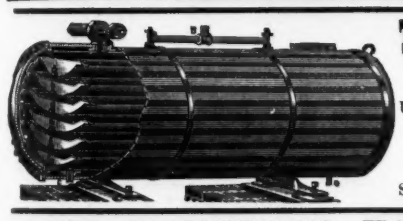

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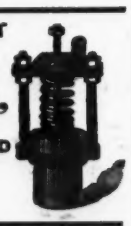

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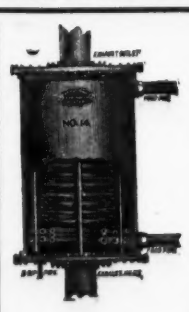

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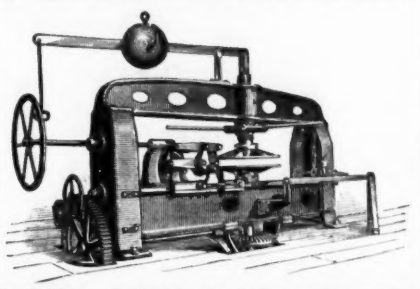

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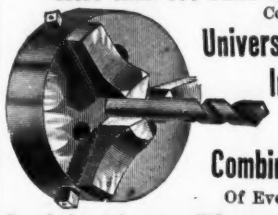

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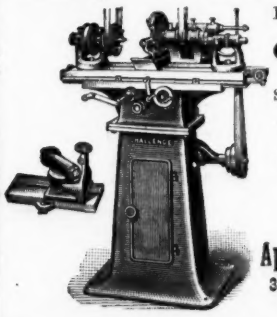

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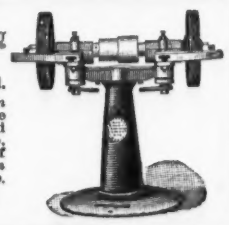

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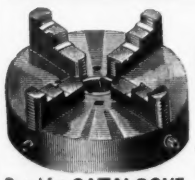

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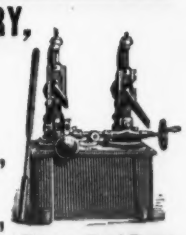

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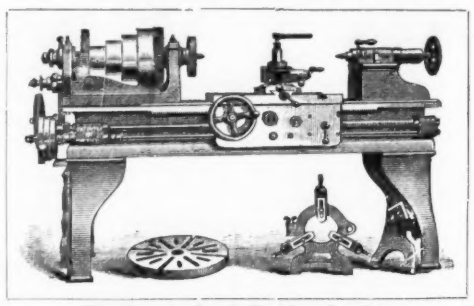

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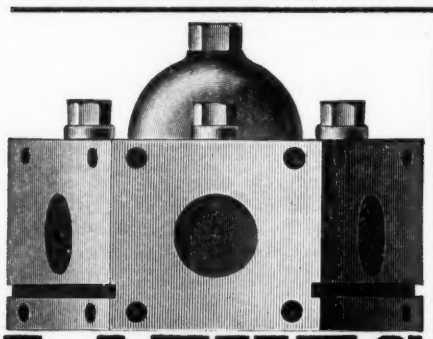

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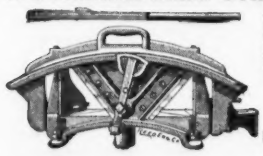

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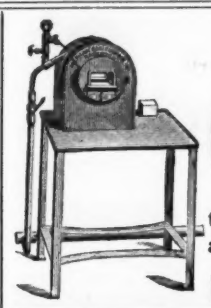

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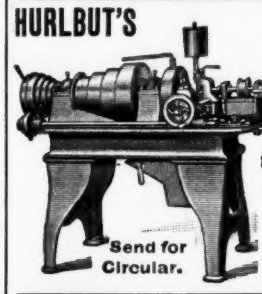

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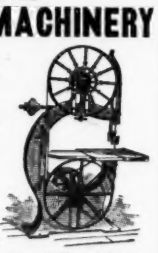

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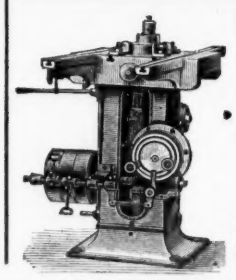

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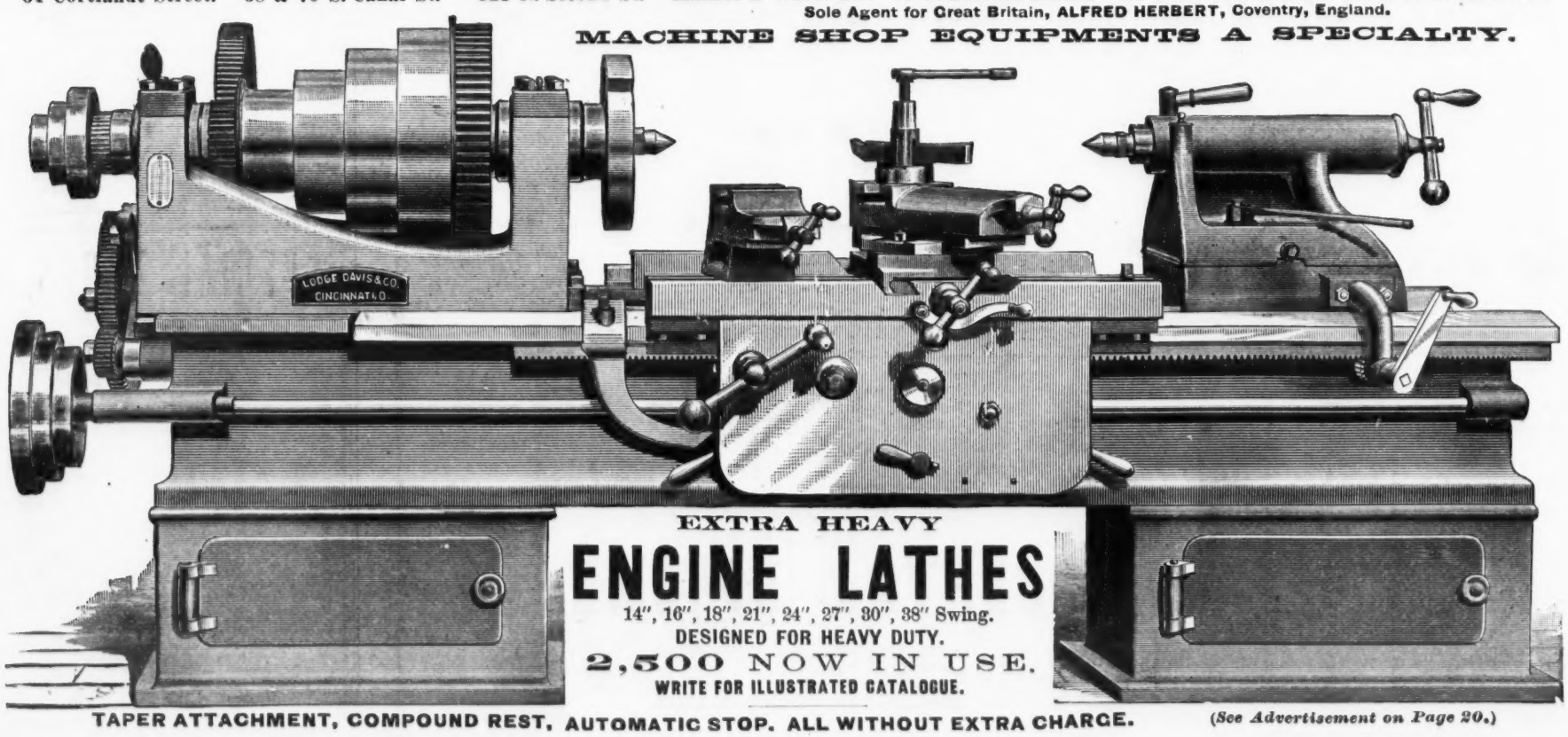

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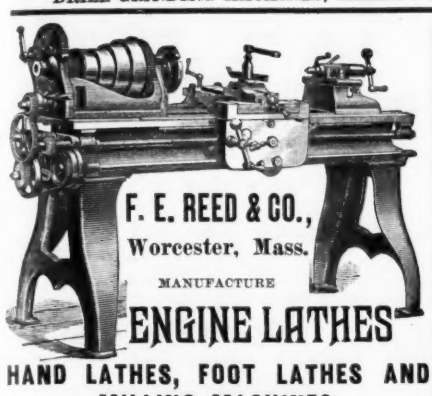

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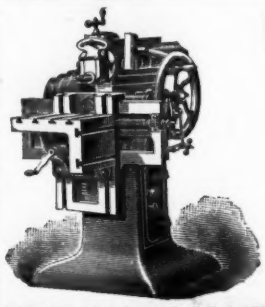

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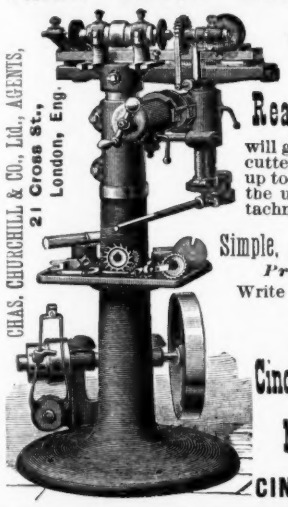

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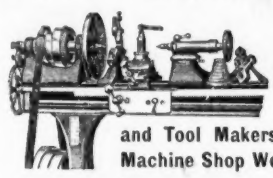

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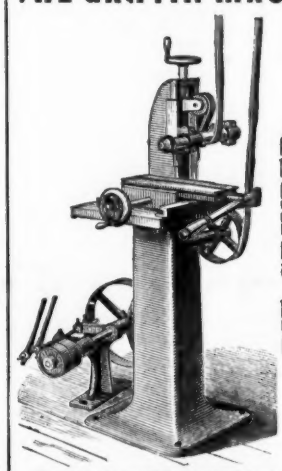

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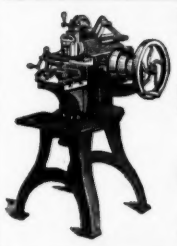

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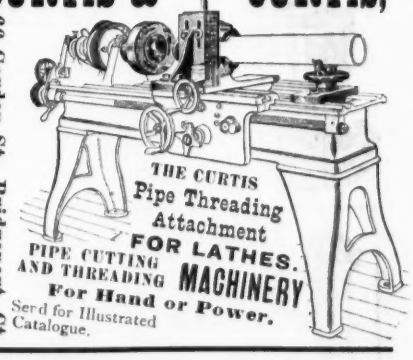

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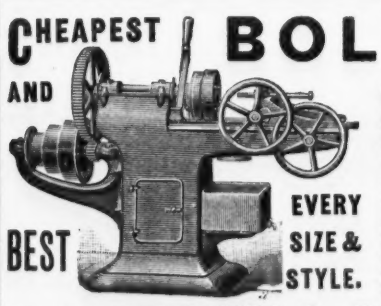

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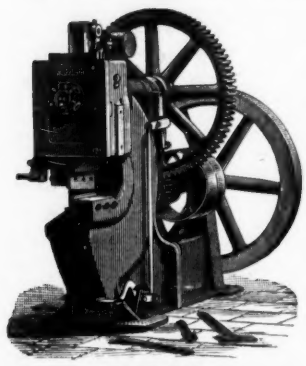

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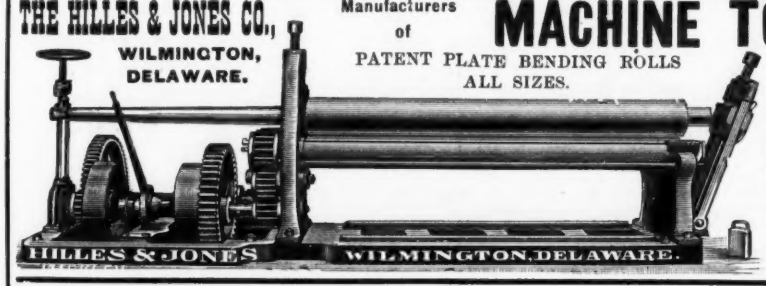

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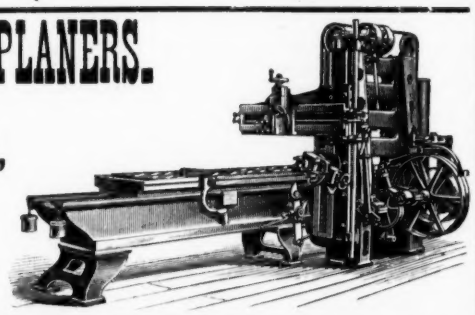

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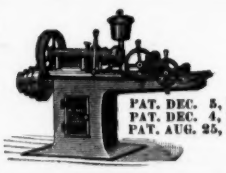

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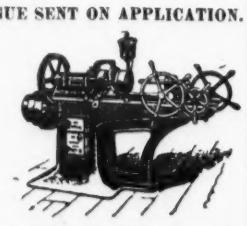

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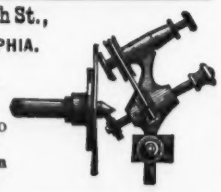

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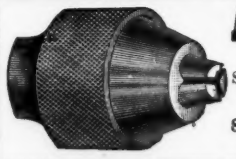

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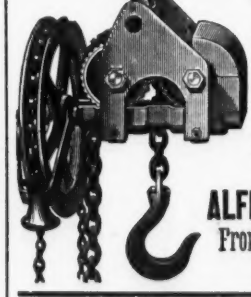

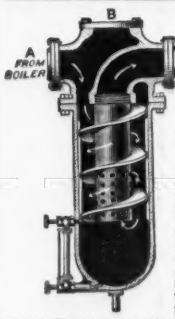

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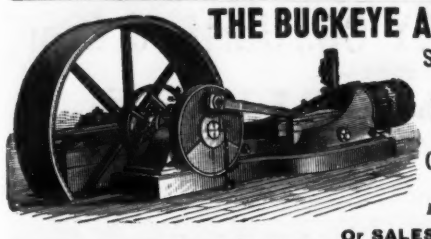

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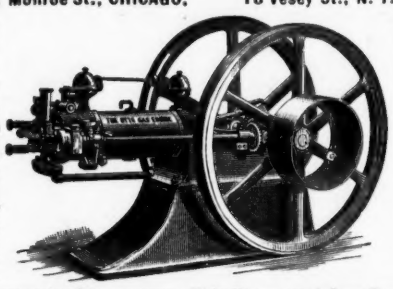

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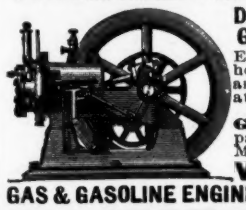

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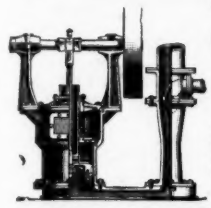

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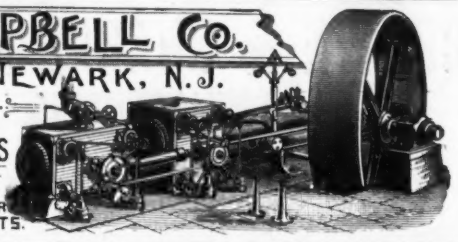

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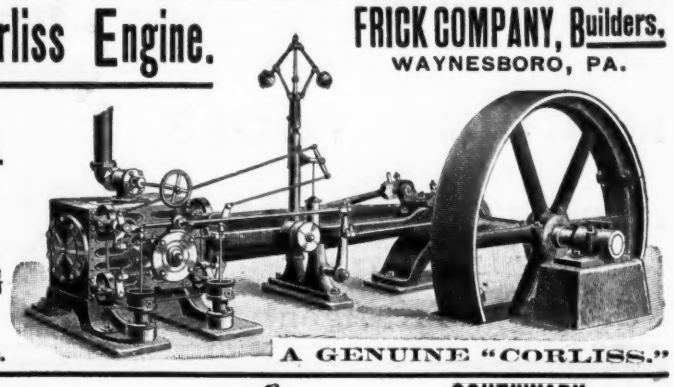

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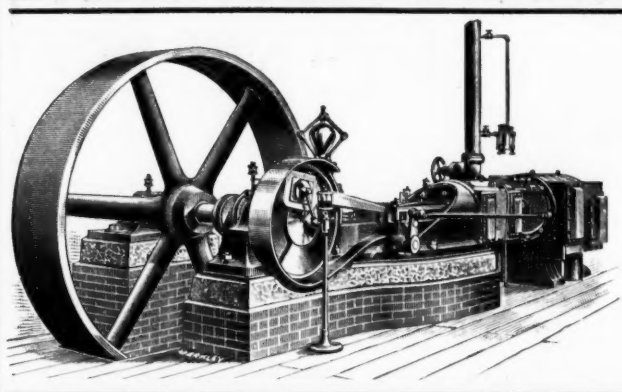

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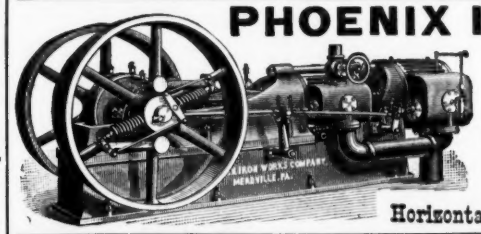

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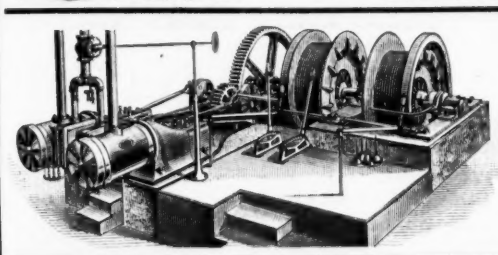

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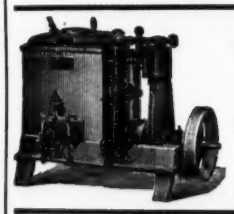

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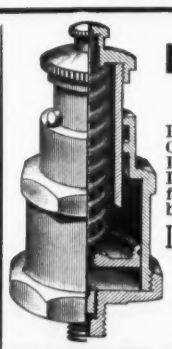

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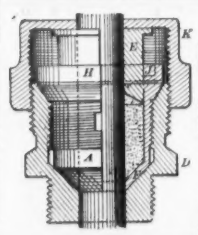

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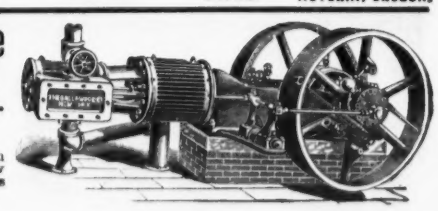

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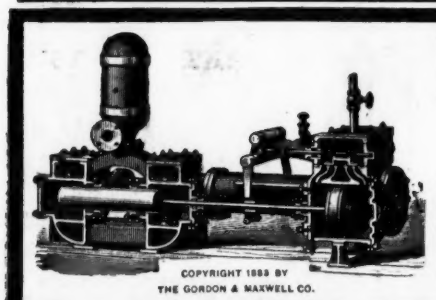

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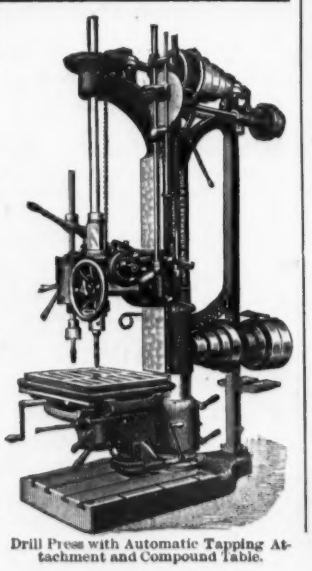

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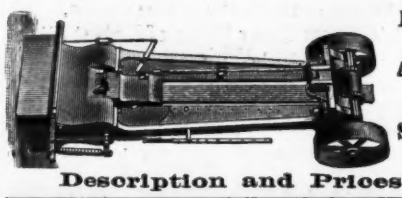

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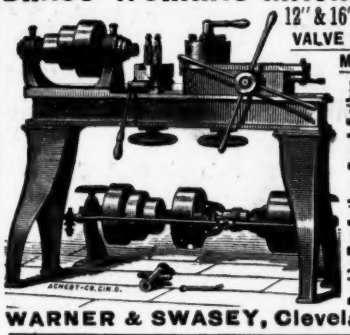

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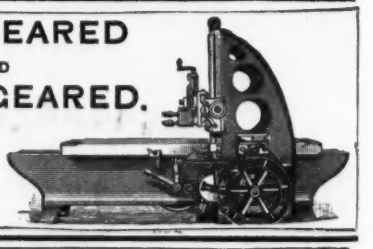

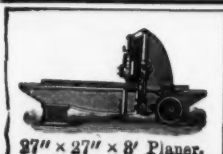

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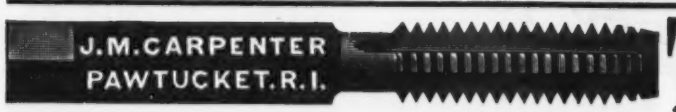

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